# **EXHIBIT A**

#### US010951680B2

# (12) United States Patent

Brueck et al.

# (10) Patent No.: US 10,951,680 B2

(45) **Date of Patent:** \*Mar. 16, 2021

# (54) APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

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(\*) Notice: Subject to any disclaimer, the term of this

patent is extended or adjusted under 35

U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-

claimer.

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# Related U.S. Application Data

- (63) Continuation of application No. 16/004,056, filed on Jun. 8, 2018, now Pat. No. 10,659,513, which is a (Continued)
- (51) Int. Cl. H04L 29/06 (2006.01) H04L 12/927 (2013.01) (Continued)
- (52) **U.S. CI.** CPC ............. *H04L 65/607* (2013.01); *G06F 16/183* (2019.01); *G06F 16/71* (2019.01);

(Continued)
(58) Field of Classification Search

CPC ...... H04N 19/34; H04N 19/40; H04N 21/234327; H04N 21/2662;

(Continued)

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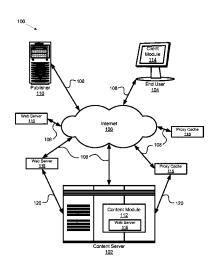
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Primary Examiner — Chirag R Patel (74) Attorney, Agent, or Firm — Lorenz & Kopf LLP

## (57) ABSTRACT

An apparatus for multi-bitrate content streaming includes a receiving module configured to capture media content, a streamlet module configured to segment the media content and generate a plurality of streamlets, and an encoding module configured to generate a set of streamlets. The system includes the apparatus, wherein the set of streamlets comprises a plurality of streamlets having identical time indices and durations, and each streamlet of the set of streamlets having a unique bitrate, and wherein the encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. A method includes receiving media content, segmenting the media content and generating a plurality of streamlets, and generating a set of streamlets.

### 29 Claims, 11 Drawing Sheets



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# Related U.S. Application Data

continuation of application No. 15/414,025, filed on Jan. 24, 2017, now Pat. No. 9,998,516, which is a continuation of application No. 14/719,122, filed on May 21, 2015, now Pat. No. 9,571,551, which is a continuation of application No. 14/106,051, filed on Dec. 13, 2013, now Pat. No. 9,071,668, which is a continuation of application No. 13/617,114, filed on Sep. 14, 2012, now Pat. No. 8,612,624, which is a continuation of application No. 12/906,940, filed on Oct. 18, 2010, now Pat. No. 8,402,156, which is a continuation of application No. 11/673,483, filed on Feb. 9, 2007, now Pat. No. 7,818,444, which is a continuation-in-part of application No. 11/116,783, filed on Apr. 28, 2005, now Pat. No. 8,868,772.

(60) Provisional application No. 60/566,831, filed on Apr. 30, 2004.

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      H04L 12/801
                           (2013.01)
      G06F 16/71
                           (2019.01)
      G06F 16/182
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      H04N 21/433
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      H04N 21/84
                          (2011.01)
      H04N 21/845
                          (2011.01)
      H04L 29/08
                          (2006.01)
      H04N 21/2662
                          (2011.01)
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(52) U.S. Cl.

CPC ....... H04L 29/06027 (2013.01); H04L 47/12 (2013.01); H04L 47/801 (2013.01); H04L 65/1069 (2013.01); H04L 65/608 (2013.01); H04L 65/608 (2013.01); H04L 65/80 (2013.01); H04L 67/02 (2013.01); H04L 67/2842 (2013.01); H04L 67/32 (2013.01); H04N 7/24 (2013.01); H04N 21/23439 (2013.01); H04N 21/2662 (2013.01); H04N 21/4331 (2013.01); H04N 21/84 (2013.01); H04N 21/8456 (2013.01)

(58) Field of Classification Search

CPC . H04N 21/2393; H04L 65/80; H04L 67/2842; H04L 65/4069; H04L 65/607; H04L 65/608

See application file for complete search history.

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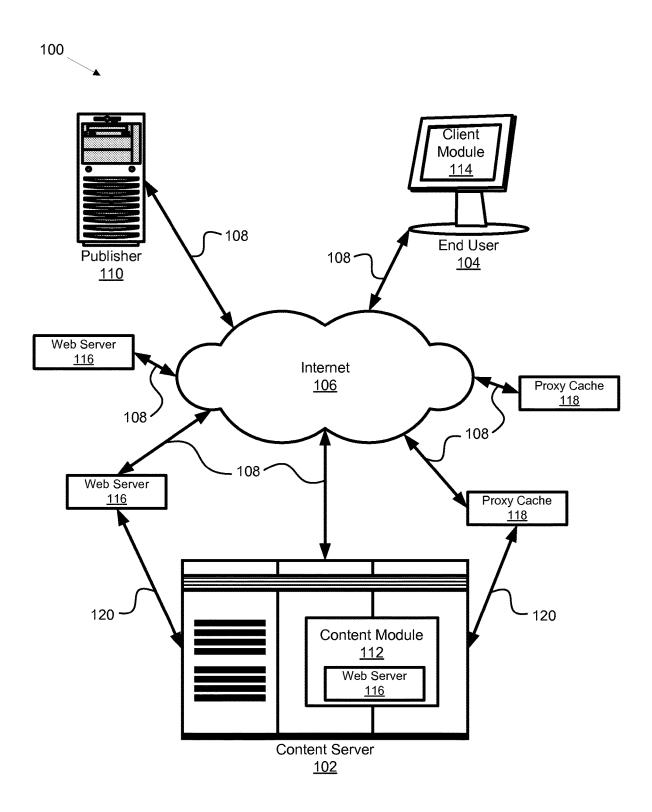


FIG. 1

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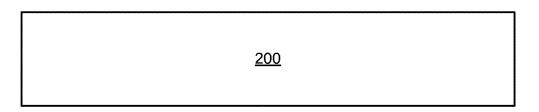


FIG. 2a

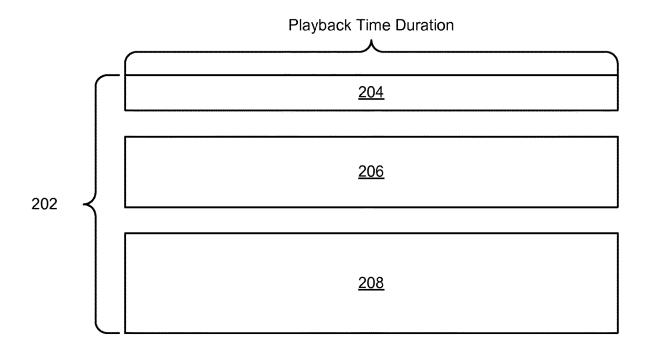


FIG. 2b

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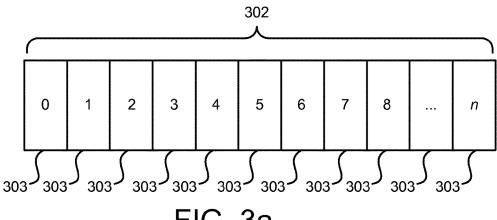


FIG. 3a

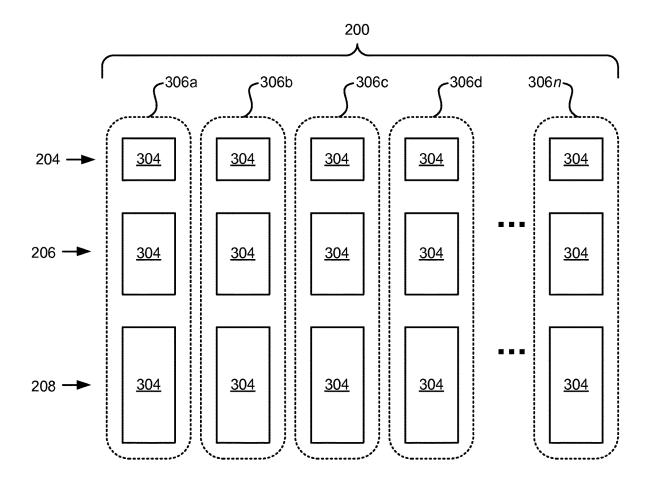
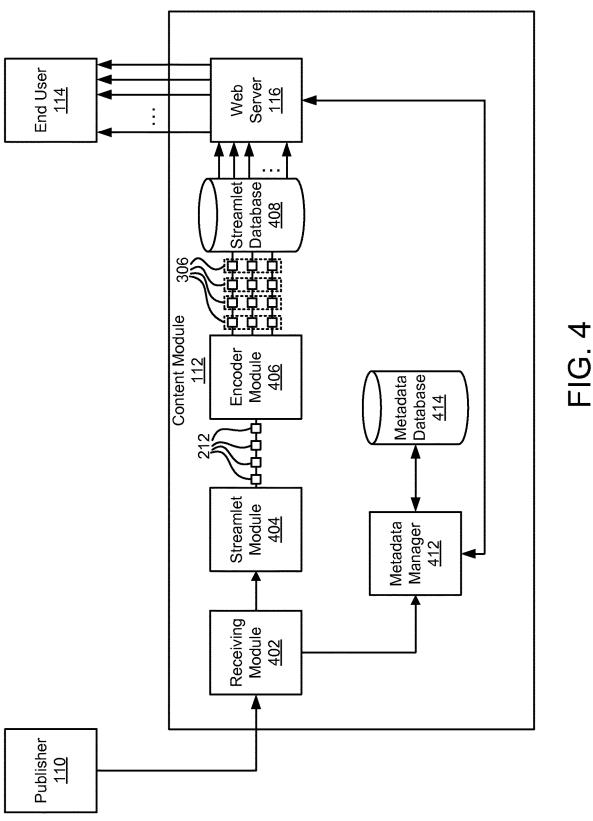


FIG. 3b

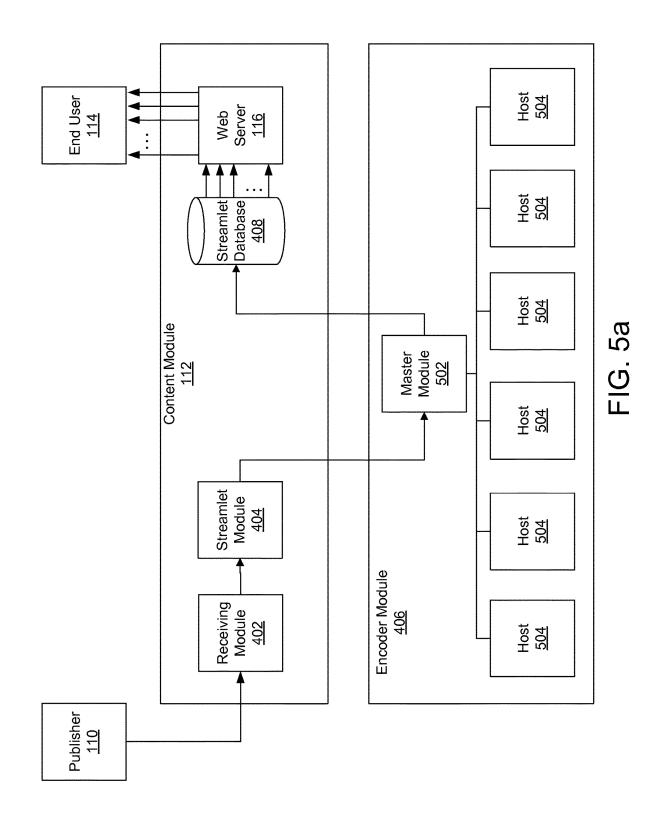
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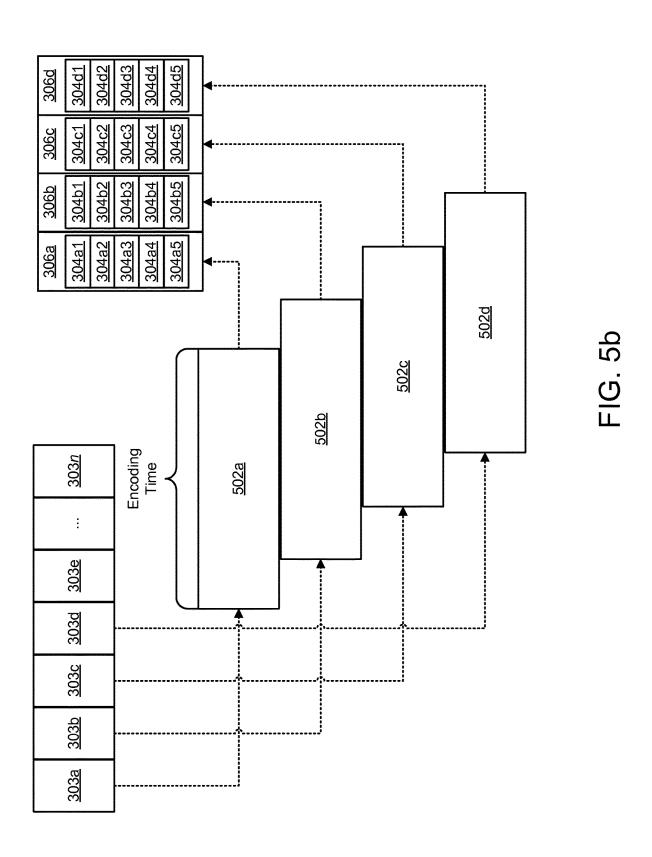
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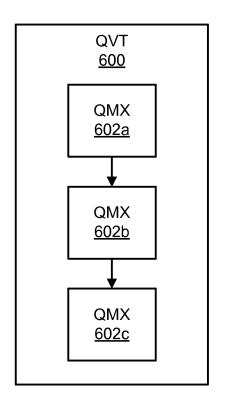


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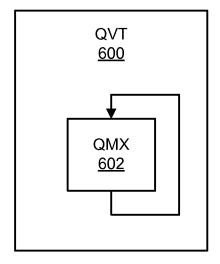


FIG. 6b

FIG. 6a

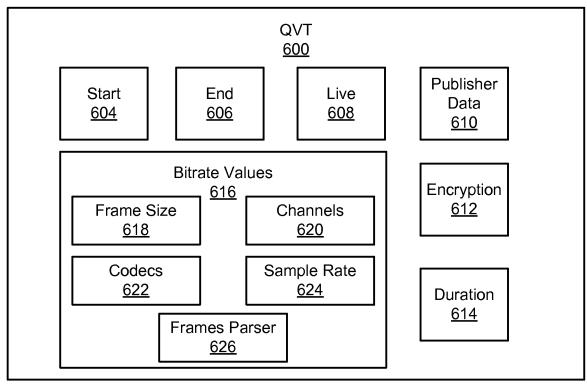
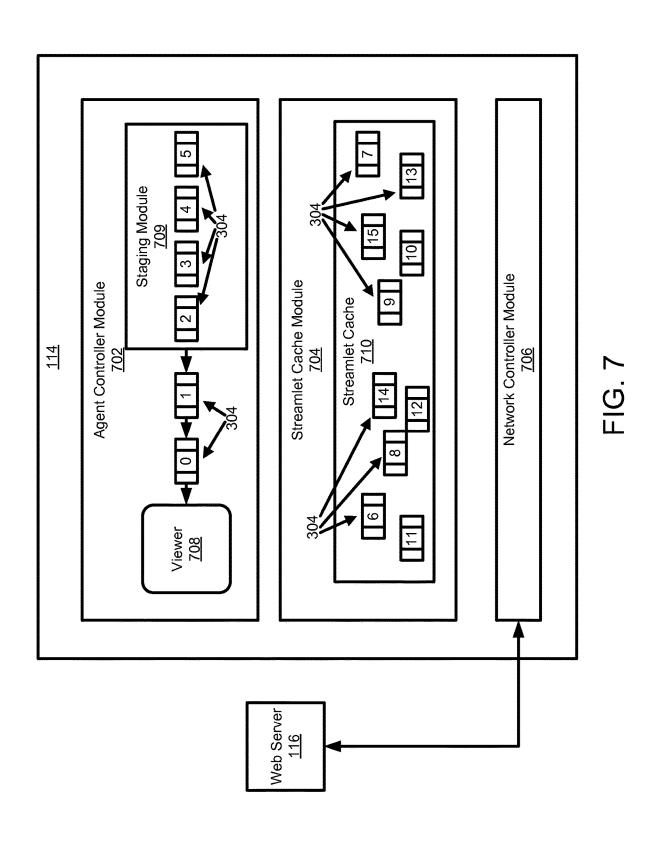


FIG. 6c

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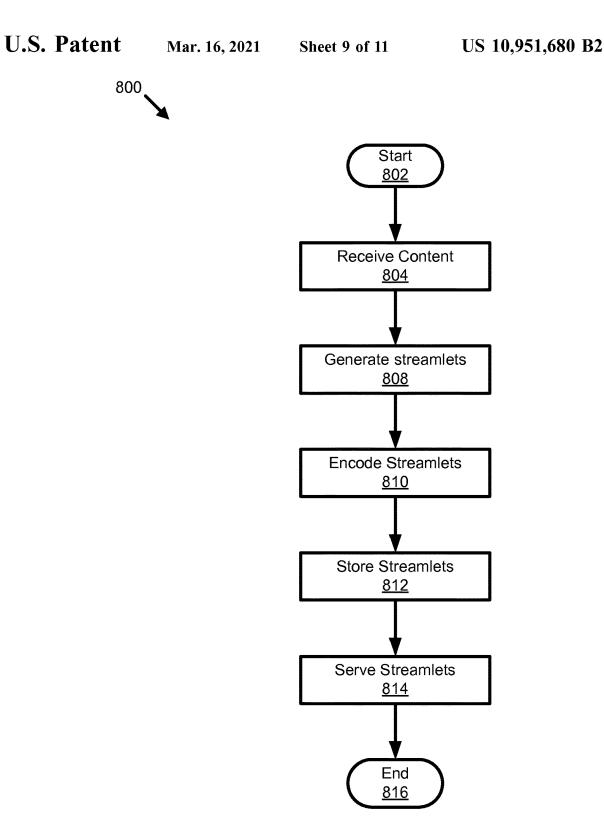


FIG. 8

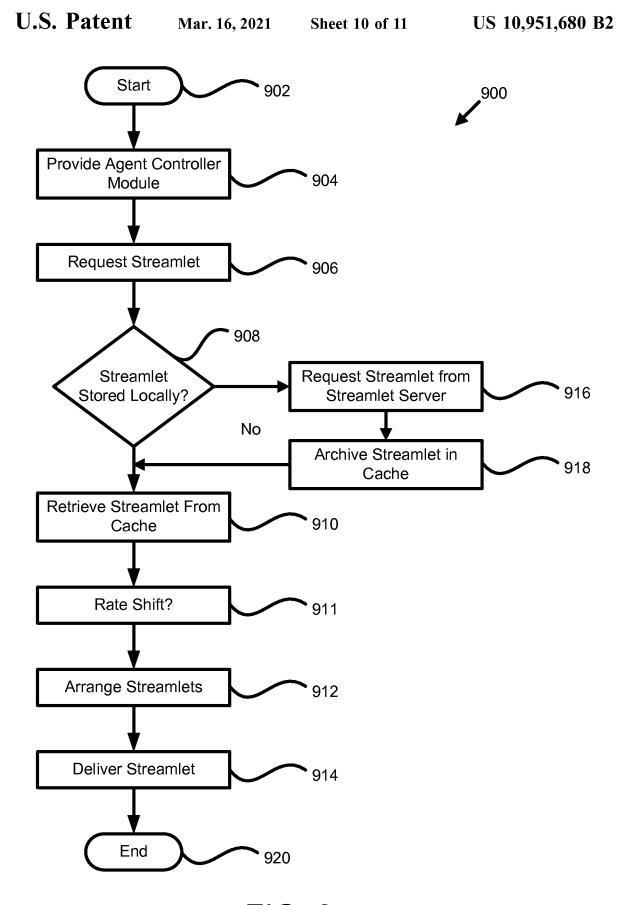
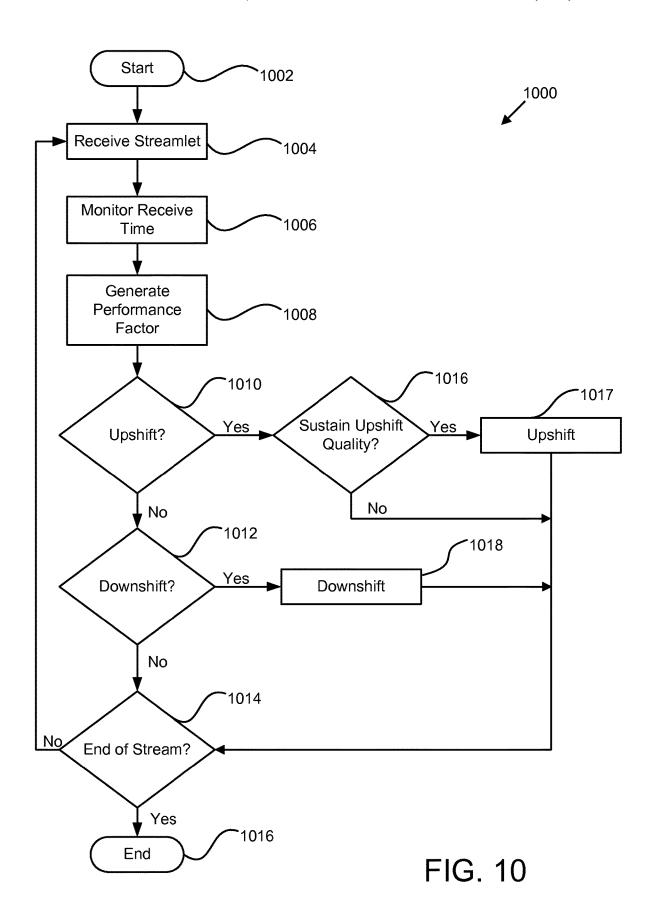


FIG. 9

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# APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

# CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 16/004,056 filed on Jun. 8, 2018, which is a continuation of U.S. patent application Ser. No. 15/414,025 (now U.S. Pat. No. 9,998,516) filed on Jan. 24, 2017, which 10 is a continuation of U.S. patent application Ser. No. 14/719, 122 filed on May 21, 2015, which is a continuation of U.S. patent application Ser. No. 14/106,051 filed on Dec. 13, 2013 (now U.S. Pat. No. 9,071,668), which is a continuation of U.S. patent application Ser. No. 13/617,114, filed on Sep. 14, 2012 (now U.S. Pat. No. 8,612,624), which is a continuation of U.S. patent Ser. No. 12/906,940 filed on Oct. 18, 2010 (now U.S. Pat. No. 8,402,156), which is a continuation of U.S. patent application Ser. No. 11/673,483, filed on Feb. 9, 2007 (now U.S. Pat. No. 7,818,444), which is a continu- 20 ation-in-part of application Ser. No. 11/116,783, filed on Apr. 28, 2005 (now U.S. Pat. No. 8,868,772), which claims the benefit of U.S. Provisional Application No. 60/566,831, filed on Apr. 31, 2004, all of which are incorporated herein by reference.

### BACKGROUND OF THE INVENTION

### Field of the Invention

The invention relates to video streaming over packet switched networks such as the Internet, and more particularly relates to adaptive-rate shifting of streaming content over such networks.

### Description of the Related Art

The Internet is fast becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or 40 practically any network capable device. Many portable media players are equipped with network connections and enabled to play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a 45 server.

"Streaming media" refers to technology that delivers content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently 50 deleted. The user has the immediate satisfaction of viewing the requested content without waiting for the media file to completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network 55 connection. Streaming may be used to deliver content on demand (previously recorded) or from live broadcasts.

Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media 60 files can take large amounts of time depending on the network connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a higher quality audio/video than can be delivered in real time. 65 Users generally dislike this option, as they tend to want to see or hear the media file instantaneously.

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Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for viewing on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also vulnerable to network failures or congestion.

Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for 35 a moment and then slowly resumes the original transmission pace. This behavior is an attempt to alleviate the perceived congestion. Such a slowdown is detrimental to the viewing or listening experience of the user and therefore is not acceptable.

The second challenge to data transport is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

The third challenge is latency. Latency is the time measure form the client's point-of-view, of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput of TCP.

From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

# SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems. Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the abovediscussed shortcomings in the art.

The apparatus for adaptive-rate content streaming is provided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include a 15 receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, and an encoding module configured to encode each streamlet as a separate content file.

The encoding module is further configured to generate a set of streamlets for each of the sequential streamlets. Each streamlet may comprise a portion of the media content having a predetermined length of time. The predetermined length of time may be in the range of between about 0.1 and 25 5 seconds.

In one embodiment, a set of streamlets comprises a plurality of streamlets having identical time indices, and each streamlet of the set of streamlets has a unique bitrate. The receiving module is configured to convert the media 30 content to raw audio or raw video. The encoding module may include a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. The job completion bid may be based on a plurality of computing 35 variables selected from a group consisting of current encoding job completion percentage, average encoding job completion time, processor speed, and physical memory

A system of the present invention is also presented for 40 adaptive-rate content streaming. In particular, the system, in one embodiment, includes a receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, each streamlet comprising a portion of 45 the media content having a predetermined length of time, and an encoding module configured to encode each streamlet as a separate content file and generate a set of streamlets.

The system also includes a plurality of streamlets having identical time indices and each streamlet of the set of 50 ing content in accordance with the present invention; streamlets having a unique bitrate. The encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid.

A method of the present invention is also presented for 55 adaptive-rate content streaming. In one embodiment, the method includes receiving media content, segmenting the media content and generating a plurality of sequential streamlets, and encoding each streamlet as a separate content

The method also includes segmenting the media content into a plurality of streamlets, each streamlet comprising a portion of the media content having a predetermined length of time. In one embodiment, the method includes generating a set of streamlets comprising a plurality of streamlets 65 having identical time indices, and each streamlet of the set of streamlets having a unique bitrate.

Furthermore, the method may include converting the media content to raw audio or raw video, and segmenting the content media into a plurality of sequential streamlets. The method further comprises assigning an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid, and submitting an encoding job completion bid based on a plurality of computing

Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specifi-20 cation may, but do not necessarily, refer to the same embodi-

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention.

These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

## BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

FIG. 1 is a schematic block diagram illustrating one embodiment of a system for dynamic rate shifting of stream-

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content file;

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth;

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of source streamlets;

FIG. 3b is a schematic block diagram illustrating one 60 embodiment of sets of streamlets in accordance with the present invention;

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module in accordance with the present invention;

FIG. 5a is a schematic block diagram illustrating one embodiment of an encoder module in accordance with the present invention;

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FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention:

FIG. **6***a* is a schematic block diagram illustrating one embodiment of a virtual timeline in accordance with the <sup>5</sup> present invention;

FIG. **6***b* is a schematic block diagram illustrating an alternative embodiment of a VT in accordance with the present invention:

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX in accordance with the present invention:

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with  $_{15}$  the present invention:

FIG. **8** is a schematic flow chart diagram illustrating one embodiment of a method for processing content in accordance with the present invention;

FIG.  $\bf 9$  is a schematic flow chart diagram illustrating one  $_{20}$  embodiment of a method for viewing a plurality of streamlets in accordance with the present invention; and

FIG. **10** is a schematic flow chart diagram illustrating one embodiment of a method for requesting streamlets within an adaptive-rate shifting content streaming environment in <sup>25</sup> accordance with the present invention.

# DETAILED DESCRIPTION OF THE INVENTION

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, 35 off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or 45 function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein 55 within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely 60 as electronic signals on a system or network.

Reference throughout this specification to "one embodiment," "an embodiment." or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one 65 embodiment of the present invention. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and

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similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

Reference to a signal bearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machine-readable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device. In one embodiment, a computer program product including a computer useable medium having a computer readable program of computer instructions stored thereon that when executed on a computer causes the computer to carry out operations for multi-bitrate content streaming as described herein.

Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention

FIG. 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user station 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured to present content. For example, portable electronic devices may include, but are not limited to, cellular phones, portable gaming systems, and portable computing devices.

In the depicted embodiment, the system 100 also includes a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For example, if the content to be streamed were a broadcast of a television program, the publisher 110 may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the Internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may be configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of locations simultaneously. For example, the client module 114 may request and receive content from any of the plurality of web servers 116.

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Content from the content server 102 may be replicated to other web servers 116 or alternatively to proxy cache servers 118. Replicating may occur by deliberate forwarding from the content server 102, or by a web, cache, or proxy server outside of the content server 102 asking for content on behalf of the client module 114. In a further embodiment, content may be forwarded directly to web 116 or proxy 118 servers through direct communication channels 120 without the need to traverse the Internet 106.

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content (hereinafter "content") file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Alternatively, the content file 200 may be compressed using standard or proprietary encoding schemes. Examples of encoding schemes capable of use with the present invention include, but are not limited to, DivX®, Windows Media Video®, Quicktime Sorenson 3®, On2, OGG Vorbis, MP3, or Quicktime 6.5/MPEG-4® encoded content.

FIG. 2b is a schematic block diagram illustrating one 25 embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the plurality of streams 202 comprises a low quality stream 204, a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content 30 file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and compressed to a bit rate of 100 kilobits per second (kbps), the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 35 208 may be encoded and compressed to 600 kbps.

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream 302 divided into a plurality of source streamlets 303. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 303 40 may comprise a portion of the content contained in stream 302, encapsulated as an independent media object. The content in a streamlet 303 may have a unique time index in relation to the beginning of the content contained in stream 302. In one embodiment, the content contained in each 45 streamlet 303 may have a duration of two seconds. For example, streamlet 0 may have a time index of 00:00 representing the beginning of content playback, and streamlet 1 may have a time index of 00:02, and so on. Alternatively, the time duration of the streamlets 304 may be any 50 duration smaller than the entire playback duration of the content in stream 302. In a further embodiment, the streamlets 303 may be divided according to file size instead of a time index and duration.

FIG. 3b is a schematic block diagram illustrating one 55 embodiment of sets 306 of streamlets in accordance with the present invention. As used herein, the term "set" refers to a group of streamlets having identical time indices and durations but varying bitrates. In the depicted embodiment, the set 306a encompasses all streamlets having a time index of 60 00:00. The set 306a includes encoded streamlets 304 having low, medium, and high 204, 206, 208 bitrates. Of course each set 306 may include more than the depicted three bitrates which are given by way of example only. One skilled in the art will recognize that any number of streams 65 having different bitrates may be generated from the original content 200.

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As described above, the duration of one streamlet 304 may be approximately two seconds. Likewise each set 306 may comprise a plurality of streamlets 304 where each streamlet 304 has a playable duration of two seconds. Alternatively, the duration of the streamlet 304 may be predetermined or dynamically variable depending upon a variety of factors including, but not limited to, network congestion, system specifications, playback resolution and quality, etc. In the depicted embodiment, the content 200 may be formed of the plurality of sets 306. The number of sets 306 may depend on the length of the content 200 and the length or duration of each streamlet 304.

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 112 may comprise a capture module 402, a streamlet module 404, an encoder module 406, a streamlet database 408, and the web server 116. In one embodiment, the capture module 402 is configured to receive the content file 200 from the publisher 110. The capture module 402 may be configured to "decompress" the content file 200. For example, if the content file 200 arrives having been encoded with one of the above described encoding schemes, the capture module 402 may convert the content file 200 into raw audio and/or video. Alternatively, the content file 200 may be transmitted by the publisher in a format 110 that does not require decompression.

The capture module **402** may comprise a capture card configured for TV and/or video capture. One example of a capture card suitable for use in the present invention is the DRC-2500 by Digital Rapids of Ontario, Canada. Alternatively, any capture card capable of capturing audio and video may be utilized with the present invention. In a further embodiment, the capture module **402** is configured to pass the content file to the streamlet module **404**.

The streamlet module 404, in one embodiment, is configured to segment the content file 200 and generate source streamlets 303 that are not encoded. As used herein, the term "segment" refers to an operation to generate a streamlet of the content file 200 having a duration or size equal to or less than the duration or size of the content file 200. The streamlet module 404 may be configured to segment the content file 200 into streamlets 303 each having an equal duration. Alternatively, the streamlet module 404 may be configured to segment the content file 200 into streamlets 303 having equal file sizes.

The encoding module 406 is configured to receive the source streamlets 303 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in the art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

In a further embodiment, the encoding module 406 is configured to generate a plurality of sets 306 of streamlets 304. The sets 306, as described above with reference to FIG. 3b, may comprise streamlets having an identical time index and duration, and a unique bitrate. As with FIG. 3b, the sets 306 and subsequently the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively, the plurality of streams 202 may comprise any number of streams deemed necessary to accommodate end user bandwidth.

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The encoder module 406 is further configured to encode each source streamlet 303 into the plurality of streams 202 and streamlet sets 306 and store the streamlets in the streamlet database 408. The encoding module 406 may utilize encoding schemes such as DivX®, Windows Media 5 Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/MPEG-4®. Alternatively, a custom encoding scheme may be employed.

The content module 112 may also include a metadata module 412 and a metadata database 414. In one embodi- 10 ment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be configured to define an end user environment. In 15 one embodiment, the publisher 100 may define an end user navigational environment for the content including menus, thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, pause, and play that may be used with the content file 200. 20 The metadata module 412 is configured to receive the metadata from the publisher 110 and store the metadata in the metadata database 414. In a further embodiment, the metadata module 412 is configured to interface with the client module 114, allowing the client module 114 to search 25 for content based upon at least one of a plurality of metadata criteria. Additionally, metadata may be generated by the content module 112 through automated process(es) or manual definition.

Once the streamlets **304** have been received and processed, the client module **114** may request streamlets **304** using HTTP from the web server **116**. Using a standard protocol such as HTTP eliminates the need for network administrators to configure firewalls to recognize and pass through network traffic for a new, specialized protocol. 35 Additionally, since the client module **114** initiates the request, the web server **116** is only required to retrieve and serve the requested streamlet **304**. In a further embodiment, the client module **114** may be configured to retrieve streamlets **304** from a plurality of web servers **116**.

Each web server 116 may be located in various locations across the Internet 106. The streamlets 304 may essentially be static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 304. Streamlets 304 may be served by the web server 116 or cached by cache servers of Internet Service Providers (ISPs), or any other network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution is provided that is not hindered by massive amounts of client module 114 requests to the web server 116 at any specific location, especially the web server 116 most closely associated with or within the content module 112

FIG. 5a is a schematic block diagram illustrating one 55 embodiment of an encoder module 406 in accordance with the present invention. In one embodiment, the encoder module 406 may include a master module 502 and a plurality of host computing modules (hereinafter "host") 504. The hosts 504 may comprise personal computers, 60 servers, etc. In a further embodiment, the hosts 504 may be dedicated hardware, for example, cards plugged into a single computer.

The master module (hereinafter "master") 502 is configured to receive streamlets 303 from the streamlet module 65 404 and stage the streamlet 303 for processing. In one embodiment, the master 502 may decompress each source

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streamlet 303 to produce a raw streamlet. As used herein, the term "raw streamlet" refers to a streamlet 303 that is uncompressed or lightly compressed to substantially reduce size with no significant loss in quality. A lightly compressed raw streamlet can be transmitted more quickly and to more hosts. Each host 504 is coupled with the master 502 and configured to receive a raw streamlet from the master 502 for encoding. The hosts 504, in one example, generate a plurality of streamlets 304 having identical time indices and durations, and varying bitrates. Essentially each host 504 may be configured to generate a set 306 from the raw streamlet 503 sent from the master 502. Alternatively, each host 504 may be dedicated to producing a single bitrate in order to reduce the time required for encoding.

Upon encoding completion, the host 504 returns the set 306 to the master 502 so that the encoding module 406 may store the set 306 in the streamlet database 408. The master 502 is further configured to assign encoding jobs to the hosts 504. Each host is configured to submit an encoding job completion bid (hereinafter "bid"). The master 502 assigns encoding jobs depending on the bids from the hosts 504. Each host 504 generates a bid depending upon a plurality of computing variables which may include, but are not limited to, current encoding job completion percentage, average job completion time, processor speed and physical memory capacity.

For example, a host 504 may submit a bid that indicates that based on past performance history the host 504 would be able to complete the encoding job in 15 seconds. The master 502 is configured to select from among a plurality of bids the best bid and subsequently submit the encoding job to the host 504 with the best bid. As such, the described encoding system does not require that each host 504 have identical hardware but beneficially takes advantage of the available computing power of the hosts 504. Alternatively, the master 502 selects the host 504 based on a first come first serve basis, or some other algorithm deemed suitable for a particular encoding job.

The time required to encode one streamlet 304 is dependent upon the computing power of the host 504, and the encoding requirements of the content file 200. Examples of encoding requirements may include, but are not limited to, two or multi-pass encoding, and multiple streams of different bitrates. One benefit of the present invention is the ability to perform two-pass encoding on a live content file 200. Typically, in order to perform two-pass encoding prior art systems must wait for the content file to be completed before encoding.

The present invention, however, segments the content file 200 into source streamlets 303 and the two-pass encoding to a plurality of streams 202 may be performed on each corresponding raw streamlet without waiting for a TV show to end, for example. As such, the content module 112 is capable of streaming the streamlets over the Internet shortly after the content module 112 begins capture of the content file 200. The delay between a live broadcast transmitted from the publisher 110 and the availability of the content depends on the computing power of the hosts 504.

FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention. In one example, the capture module 402 (of FIG. 4) begins to capture the content file and the streamlet module 404 generates a first streamlet 303a and passes the streamlet to the encoding module 406. The encoding module 406 may take 10 seconds, for example, to generate the first set 306a of streamlets 304a (304a1, 304a2, 304a3, etc. represent streamlets 304 of

different bitrates). FIG. 5b illustrates the encoding process generically as block 502 to graphically illustrate the time duration required to process a raw or lightly encoded streamlet 303 as described above with reference to the encoding module 406. The encoding module 406 may simultaneously process more than one streamlet 303, and processing of streamlets will begin upon arrival of the streamlet from the capture module 402.

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During the 10 seconds required to encode the first streamlet 303a, the streamlet module 404 has generated five additional 2-second streamlets 303b, 303c, 303d, 303e, 303f, for encoding and the master 502 has prepared and staged the corresponding raw streamlets. Two seconds after the first set 306a is available the next set 306b is available, and so on. As such, the content file 200 is encoded for streaming over the Internet and appears live. The 10 second delay is given herein by way of example only. Multiple hosts 504 may be added to the encoding module 406 in order to increase the processing capacity of the encoding module 406. The delay may be shortened to an almost unperceivable level by the addition of high CPU powered systems, or alternatively multiple low powered systems.

A system as described above beneficially enables multipass encoding of live events. Multi-pass encoding systems 25 of the prior art require that the entire content be captured (or be complete) because in order to perform multi-pass encoding the entire content must be scanned and processed more than once. This is impossible with prior art systems because content from a live event is not complete until the event is 30 over. As such, with prior art systems, multi-pass encoding can only be performed once the event is over. Streamlets, however, may be encoded as many times as is deemed necessary. Because the streamlet is an encapsulated media object of 2 seconds (for example), multi-pass encoding may 35 begin on a live event once the first streamlet is captured. Shortly after multi-pass encoding of the first streamlet 303a is finished, multi-pass encoding of the second streamlet 303b finishes, and as such multi-pass encoding is performed on a live event and appears live to a viewer.

Any specific encoding scheme applied to a streamlet may take longer to complete than the time duration of the streamlet itself, for example, a very high quality encoding of a 2-second streamlet may take 5 seconds to finish. Alternatively, the processing time required for each streamlet may 45 be less than the time duration of a streamlet. However, because the offset parallel encoding of successive streamlets are encoded by the encoding module at regular intervals (matching the intervals at which the those streamlets are submitted to the encoding module 406, for example 2 50 seconds) the output timing of the encoding module 406 does not fall behind the real-time submission rate of the unencoded streamlets. Conversely, prior art encoding systems rely on the very fastest computing hardware and software because the systems must generate the output immediately 55 in lock-step with the input. A prior art system that takes 2.1 seconds to encode 2 seconds worth of content is considered a failure. The present invention allows for slower than real-time encoding processes yet still achieves a real-time encoding effect due to the parallel offset pipes.

The parallel offset pipeline approach described with reference to FIG. 5b beneficially allows for long or short encoding times without "falling behind" the live event. Additionally, arbitrarily complex encoding of streamlets to multiple profiles and optimizations only lengthens the 65 encoding time 502 without a perceptible difference to a user because the sets 306 of streamlets 304 are encoded in a

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time-selective manner so that streamlets are processed at regular time intervals and transmitted at these time intervals.

Returning now to FIG. 5a, as depicted, the master 502 and the hosts 504 may be located within a single local area network, or in other terms, the hosts 504 may be in close physical proximity to the master 502. Alternatively, the hosts 504 may receive encoding jobs from the master 502 over the Internet or other communications network. For example, consider a live sports event in a remote location where it would be difficult to setup multiple hosts. In this example, a master performs no encoding or alternatively light encoding before publishing the streamlets online. The hosts 504 would then retrieve those streamlets and encode the streamlets into the multiple bitrate sets 306 as described above.

Furthermore, hosts **504** may be dynamically added or removed from the encoding module without restarting the encoding job and/or interrupting the publishing of streamlets. If a host **504** experiences a crash or some failure, its encoding work is simply reassigned to another host.

The encoding module 406, in one embodiment, may also be configured to produce streamlets that are specific to a particular playback platform. For example, for a single raw streamlet, a single host 504 may produce streamlets for different quality levels for personal computer playback, streamlets for playback on cell phones with a different, proprietary codec, a small video-only streamlet for use when playing just a thumbnail view of the stream (like in a programming guide), and a very high quality streamlet for use in archiving.

FIG. 6a is a schematic block diagram illustrating one embodiment of a virtual timeline 600 in accordance with the present invention. In one embodiment, the virtual timeline 600 comprises at least one quantum media extension 602. The quantum media extension (hereinafter "QMX") 602 describes an entire content file 200. Therefore, the virtual timeline (hereinafter "VT") 600 may comprise a file that is configured to define a playlist for a user to view. For example, the VT may indicate that the publisher desires a user to watch a first show QMX 602a followed by QMX 602b and QMX 602c. As such, the publisher may define a broadcast schedule in a manner similar to a television station.

FIG. 6b is a schematic block diagram illustrating an alternative embodiment of a VT 600 in accordance with the present invention. In the depicted embodiment, the VT 600 may include a single QMX 602 which indicates that the publisher desires the same content to be looped over and over again. For example, the publisher may wish to broadcast a never-ending infomercial on a website.

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX 602 in accordance with the present invention. In one embodiment, the QMX 602 contains a multitude of information generated by the content module 112 configured to describe the content file 200. Examples of information include, but are not limited to, start index 604, end index 606, whether the content is live 608, proprietary publisher data 610, encryption level 612, content duration 614 and bitrate values 616. The bitrate values 616 may include frame size 618, audio channel 620 information, codecs 622 used, sample rate 624, and frames parser 626.

A publisher may utilize the QVT 600 together with the QMX 602 in order to prescribe a playback order for users, or alternatively selectively edit content. For example, a publisher may indicate in the QMX 602 that audio should be muted at time index 10:42 or video should be skipped for 3 seconds at time index 18:35. As such, the publisher may

selectively skip offensive content without the processing requirements of editing the content.

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module 114 in accordance with the present invention. The client module 114 may 5 comprise an agent controller module 702, a streamlet cache module 704, and a network controller module 706. In one embodiment, the agent controller module 702 is configured to interface with a viewer 708, and transmit streamlets 304 to the viewer 708. Alternatively, the agent controller module 10 702 may be configured to simply reassemble streamlets into a single file for transfer to an external device such as a portable video player.

In a further embodiment, the client module **114** may comprise a plurality of agent controller modules **702**. Each 15 agent controller module **702** may be configured to interface with one viewer **708**. Alternatively, the agent controller module **702** may be configured to interface with a plurality of viewers **708**. The viewer **708** may be a media player (not shown) operating on a PC or handheld electronic device.

The agent controller module **702** is configured to select a quality level of streamlets to transmit to the viewer **708**. The agent controller module **702** requests lower or higher quality streams based upon continuous observation of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to FIG. **10**.

The agent controller module 702 may be configured to receive user commands from the viewer 708. Such commands may include play, fast forward, rewind, pause, and stop. In one embodiment, the agent controller module 702 requests streamlets 304 from the streamlet cache module 704 and arranges the received streamlets 304 in a staging module 709. The staging module 709 may be configured to arrange the streamlets 304 in order of ascending playback time. In the depicted embodiment, the streamlets 304 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 304 may be identified with a unique filename.

Additionally, the agent controller module 702 may be 40 configured to anticipate streamlet 304 requests and prerequest streamlets 304. By pre-requesting streamlets 304, the user may fast-forward, skip randomly, or rewind through the content and experience no buffering delay. In a further embodiment, the agent controller module 702 may request 45 the streamlets 304 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 702 may request streamlets at any interval less than the length of the time index. This enables a "fast-start" capability with no buffer- 50 ing wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 702 may be configured to pre-request streamlets 304 corresponding to specified index points within the content or within other content in anticipation of the end user 104 55 selecting new content to view. In one embodiment, the streamlet cache module 704 is configured to receive streamlet 304 requests from the agent controller module 702. Upon receiving a request, the streamlet cache module 704 first checks a streamlet cache 710 to verify if the streamlet 304 60 is present. In a further embodiment, the streamlet cache module 704 handles streamlet 304 requests from a plurality of agent controller modules 702. Alternatively, a streamlet cache module 704 may be provided for each agent controller module 702. If the requested streamlet 304 is not present in 65 the streamlet cache 410, the request is passed to the network controller module 706. In order to enable fast forward and

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rewind capabilities, the streamlet cache module 704 is configured to store the plurality of streamlets 304 in the streamlet cache 710 for a specified time period after the streamlet 304 has been viewed. However, once the streamlets 304 have been deleted, they may be requested again from the web server 116.

The network controller module 706 may be configured to receive streamlet requests from the streamlet cache module 704 and open a connection to the web server 116 or other remote streamlet 304 database (not shown). In one embodiment, the network controller module 706 opens a TCP/IP connection to the web server 116 and generates a standard HTTP GET request for the requested streamlet 304. Upon receiving the requested streamlet 304, the network controller module 706 passes the streamlet 304 to the streamlet cache module 704 where it is stored in the streamlet cache 710. In a further embodiment, the network controller module 706 is configured to process and request a plurality of streamlets 304 simultaneously. The network controller module 706 20 may also be configured to request a plurality of streamlets, where each streamlet 304 is subsequently requested in multiple parts.

In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 304 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates problems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 304. Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more useful and predictable timing.

In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by the client as a forward cache. By requesting more than one streamlet 304 at a time in a manner referred to as "parallel retrieval," or more than one part of a streamlet 304 at a time, efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 304 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection fail. Streamlet 304 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from falling into a slow-start or close mode. If the network controller module 706 has requested a streamlet 304 in multiple parts, with each part requested on mutually independent TCP/IP connections, the network controller module 706 reassembles the parts to present a complete streamlet 304 for use by all other components of the client module 114.

When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet **304**. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet **304**. If the first streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the redundant request response, the first request may be aborted.

Several streamlet 304 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This eliminates all but the first request latency. Because multiple responses are always being transmitted, the processing

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latency of each new streamlet 304 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious vulnerabilities. Transmission delays affect all of the responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

Multiple TCP connections may be opened between the client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while maintaining the independence of each streamlet 304 request. Several streamlet 304 requests may be sent concurrently, 15 with each request being sent on a mutually distinct TCP connection. This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 20 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does not affect the transmission of other responses because each response occupies an independent TCP connection. Any 25 transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding responses.

A single streamlet 304 request may be issued for an entire streamlet 304, or multiple requests may be issued, each for 30 a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by the client module 114 streamlet.

In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new 35 streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three streamlet 304 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses diminishes the net response time of the other three responses. The 45 timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to maintain the proper balance of efficiency and response times.

The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the 50 depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof, of the illustrated method. Additionally, the format and symbols 55 employed are provided to explain the logical steps of the method and are understood not to limit the scope of the method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood not to limit the scope of the corresponding method. Indeed, 60 some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumerated steps of the depicted method. Additionally, the order in which a particular method occurs 65 may or may not strictly adhere to the order of the corresponding steps shown.

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FIG. 8 is a schematic flow chart diagram illustrating one embodiment of a method 800 for processing content in accordance with the present invention. In one embodiment the method 800 starts 802, and the content module 112 receives 804 content from the publisher 110. Receiving content 804 may comprise receiving 804 a digital copy of the content file 200, or digitizing a physical copy of the content file 200. Alternatively, receiving 804 content may comprise capturing a radio, television, cable, or satellite broadcast. Once received 804, the streamlet module 404 generates 808 a plurality of source streamlets 303 each having a fixed duration. Alternatively, the streamlets 303 may be generated with a fixed file size.

In one embodiment, generating 808 streamlets comprises dividing the content file 200 into a plurality of two second streamlets 303. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202. The encoder module 406 then encodes 810 the streamlets 303 into sets 306 of streamlets 304, in a plurality of streams 202 according to an encoding scheme. The quality may be predefined, or automatically set according to end user bandwidth, or in response to pre-designated publisher guidelines

In a further embodiment, the encoding scheme comprises a proprietary codec such as WMV9®. The encoder module 406 then stores 812 the encoded streamlets 304 in the streamlet database 408. Once stored 812, the web server 116 may then serve 814 the streamlets 304. In one embodiment, serving 814 the streamlets 304 comprises receiving streamlet requests from the client module 114, retrieving the requested streamlet 304 from the streamlet database 408, and subsequently transmitting the streamlet 304 to the client module 114. The method 800 then ends 816.

FIG. 9 is a schematic flow chart diagram illustrating one embodiment of a method 900 for viewing a plurality of streamlets in accordance with the present invention. The method 900 starts and an agent controller module 702 is provided 904 and associated with a viewer 708 and provided with a staging module 709. The agent controller module 702 then requests 906 a streamlet 304 from the streamlet cache module 704. Alternatively, the agent controller module 702 may simultaneously request 906 a plurality of streamlets 304 the streamlet cache module 704. If the streamlet is stored 908 locally in the streamlet cache 710, the streamlet cache module 704 retrieves 910 the streamlet 304 and sends the streamlet to the agent controller module 702. Upon retrieving 910 or receiving a streamlet, the agent controller module 702 makes 911 a determination of whether or not to shift to a higher or lower quality stream 202. This determination will be described below in greater detail with reference to FIG. 10.

In one embodiment, the staging module 709 then arranges 912 the streamlets 304 into the proper order, and the agent controller module 702 delivers 914 the streamlets to the viewer 708. In a further embodiment, delivering 914 streamlets 304 to the end user comprises playing video and or audio streamlets on the viewer 708. If the streamlets 304 are not stored 908 locally, the streamlet request is passed to the network controller module 706. The network controller module 706 then requests 916 the streamlet 304 from the web server 116. Once the streamlet 304 is received, the network controller module 706 passes the streamlet to the streamlet cache module 704. The streamlet cache module 704 archives 918 the streamlet. Alternatively, the streamlet cache module 704 then archives 918 the streamlet and passes the streamlet to the agent controller module 702, and the method 900 then continues from operation 910 as described above.

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Referring now to FIG. 10, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 1000 for requesting streamlets 304 within an adaptive-rate shifting content streaming environment in accordance with the present invention. The method 1000 may be used in one embodiment as the operation 911 of FIG. 9. The method 1000 starts and the agent controller module 702 receives 1004 a streamlet 304 as described above with reference to FIG. 9. The agent controller module 702 then monitors 1006 the receive time of the requested streamlet. In one embodiment, the agent controller module 702 monitors the time intervals A between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given  $\Delta$  may vary substantially from another. In order to compensate for this fluctuation, the agent controller module **702** calculates **1008** a performance ratio r across a window of n samples for  $_{20}$  streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation:

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}$$

Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ratio r, the agent controller module 702 may calculate a geometric mean, or alternatively an equivalent averaging algorithm, across a window of size m, and obtain a performance factor  $\phi\colon$ 

$$\varphi_{current} = \left(\prod_{j=1}^{m} r_j\right)^{\frac{1}{m}}$$

The policy determination about whether or not to upshift 1010 playback quality begins by comparing  $\phi_{\it current}$  with a trigger threshold  $\Theta_{up}$ . If  $\phi_{current} \ge \Theta_{up}$ , then an up shift to the next higher quality stream may be considered 1016. In one 45 embodiment, the trigger threshold  $\Theta_{up}$  is determined by a combination of factors relating to the current read ahead margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 709 for presentation at the current playback time index), and 50 a minimum safety margin. In one embodiment, the minimum safety margin may be 24 seconds. The smaller the read ahead margin, the larger  $\Theta_{up}$  is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 702 is 55 able to sustain 1016 upshift quality, then the agent controller module 702 will upshift 1017 the quality and subsequently request higher quality streams. The determination of whether use of the higher quality stream is sustainable 1016 is made by comparing an estimate of the higher quality 60 archived content. stream's performance factor,  $\varphi_{higher}$ , with  $\Theta_{up}$ . If  $\varphi_{higher} \ge \Theta_{up}$  then use of the higher quality stream is considered sustainable. If the decision of whether or not the higher stream rate is sustainable 1016 is "no," the agent controller module 702 will not attempt to upshift 1017 stream quality. 65 If the end of the stream has been reached 1014, the method 1000 ends 1016.

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If the decision on whether or not to attempt upshift 1010 is "no", a decision about whether or not to downshift 1012 is made. In one embodiment, a trigger threshold  $\Theta_{down}$  is defined in a manner analogous to  $\Theta_{up}$ . If  $\varphi_{current} > \Theta_{down}$  then the stream quality may be adequate, and the agent controller module 702 does not downshift 1018 stream quality. However, if  $\varphi_{current} > \Theta_{down}$ , the agent controller module 702 does downshift 1018 the stream quality. If the end of the stream has not been reached 1014, the agent controller module 702 begins to request and receive 1004 lower quality streamlets and the method 1000 starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced by alternative streamlet monitoring solutions.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

- 1. A system for adaptive-rate content streaming of video playable on one or more end user stations over the Internet, the system comprising:
  - at least one processor executing non-transitory executable instructions for generating at least one virtual timeline corresponding to the video;
  - wherein the video encoded at a plurality of different bitrates creating a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, the low quality stream, the medium quality stream, and the high quality stream each comprising a group of streamlets encoded at a respective one of the plurality of different bitrates, each group of streamlets comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;
  - wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and
  - wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in each of the low quality stream, the medium quality stream, and the high quality stream, and wherein the first streamlet of the low quality stream encodes the same first portion of the video at a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream.
  - 2. The system of claim 1, wherein the processor is further for generating a plurality of virtual timelines wherein each virtual timeline corresponds to each of t the low quality stream, the medium quality stream, and the high quality stream.
  - 3. The system of claim 1, wherein the video is a live event video.
  - **4**. The system of claim **1**, wherein the video includes archived content.
  - 5. The system of claim 1, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.

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- **6.** The system of claim **5**, wherein the first and second durations are different.
  - 7. The system of claim 1, further comprising: a plurality of web servers located at different locations across the internet, each web server configured to: 5 receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing a portion of the video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate 15 version of the streams; retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and send the retrieved first streamlet from the currently selected one 20 of the different copies to the requesting one of the end user stations over the one or more network connections.
  - 8. The system of claim 1, further comprising:
  - a first web server configured to:
  - receive at least one virtual timeline request over the one 25 or more internet connections from the one or more end user stations to retrieve a virtual timeline; and send the virtual timeline to the requesting one of the end user stations over the one or more network connections.
- **9**. The system of claim **8**, wherein the first web server is 30 further configured to:
  - receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the video,
  - wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user 40 station to select a higher or lower bitrate version of the video; retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and send the retrieved first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream to the requesting one of the end user stations over the one or more network connections.
- 10. The system of claim 1, wherein the at least one virtual 50 timeline corresponds to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.
- 11. The system of claim 1, wherein the virtual timeline defines a playlist for a user to view.
- 12. The system of claim 1, wherein the virtual timeline comprises a file that is configured to define a playlist for a user to view.
- 13. The system of claim 12, wherein the virtual timeline comprises at least one quantum media extension (QMX).
- **14**. An end user station to stream a video over a network from a server for playback of the video, the content player device comprising:
  - a processor;
  - a digital processing apparatus memory device comprising 65 non-transitory machine-readable instructions that, when executed, cause the processor to:

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- establish one or more network connections between the end user station and the server, wherein the server is configured to access at least one of a plurality of groups of streamlets;
  - wherein the video is encoded at a plurality of different bitrates to create a plurality of streams including at least a low quality stream, a medium quality stream, and a high quality stream, each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded at the same respective one of the different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;
  - wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bit rate of no less than 600 kbps; and wherein the first streamlets of each of the low quality stream, the medium quality stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes the same portion of the video at a different one of the different bitrates:
- select a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams;
- place at least one virtual timeline request for at least one virtual times based on the selected one of the he low quality stream, the medium quality stream, and the high quality stream; and

receive the at least one virtual timeline.

- **15**. The end user station of claim **14**, wherein the non-transitory machine-readable instructions that, when executed, further cause the processor to:
  - place one or more streamlet requests to the server over the one or more network connections for the first streamlet of the selected stream; receive the requested first streamlet from the server via the one or more network connections wherein the one or more streamlet requests are based on the at least one virtual timeline; and
  - provide the received first streamlet for playback of the video.
- 16. The end user station of claim 14, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.
- 17. The end user station of claim 16, wherein the first and second durations are different.
- 18. The end user station of claim 17, wherein the virtual timeline corresponds to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.
- 19. The end user station of claim 18, wherein the virtual 60 timeline defines a playlist for a user to view.
  - 20. The end user station of claim 14, wherein the video is a live event video.
  - 21. The end user station of claim 14, wherein the video includes archived content.
  - 22. A process executable by one or more servers to stream a video for playback by one or more end user stations, the process comprising:

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storing, by the one or more servers, one or more virtual timelines corresponding to a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;

wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different one of the different bitrates than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;

receiving at least one virtual timeline request over one or more internet connections from the one or more end user stations to retrieve a virtual timeline correspond to the first streamlet storing the first portion of the video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the video;

retrieving from the storage device the requested virtual timeline for the currently selected one of the low quality stream, the medium quality stream, and the high <sup>35</sup> quality stream; and

sending the retrieved virtual timeline to the requesting one of the end user stations over the one or more network connections.

23. The process of claim 22, further comprising:

storing, by the one or more servers, a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream; and

receiving at least one streamlet request over one or more internet connections from the one or more end user 45 stations to retrieve the first streamlet storing the first portion of the video,

wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the video

retrieving from the storage device the requested first 55 streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and

sending the retrieved first streamlet from the currently selected one of the low quality stream, the medium for quality stream, and the high quality stream to the requesting one of the end user stations over the one or more network connections.

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- 24. The process of claim 22, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.
- 25. The process of claim 22, wherein the first and second durations are different.
- 26. The process of claim 22, wherein the video is a live event video.
- 27. The process of claim 22, wherein the video includes archived content.
- **28**. A process executable by a content player device to stream a video over a network from a server for playback of the video by the content player device, the process comprising:

establishing one or more network connections between the content player device and the server,

wherein the server accesses a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video; wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;

selecting, by the content player device, a currently selected one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the video;

placing a virtual time request over one or more internet connections from the one or more end user stations to retrieve at least one virtual timeline corresponding to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream;

receiving the requested virtual timeline from the server via the one or more network connections.

29. The process of claim 28 further comprising: placing a streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the video, wherein the streamlet request is based, at least in part, on the received virtual timeline;

receiving the requested streamlet from the server via the one or more network connections; and rendering, by the content player device, the received streamlet for playback of the video.

\* \* \* \* \*

# EXHIBIT B

# (12) United States Patent Bruck et al.

# (54) APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

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This patent is subject to a terminal dis-

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### (58) Field of Classification Search

CPC ...... H04N 21/2662; H04L 65/70; H04L 65/80 See application file for complete search history.

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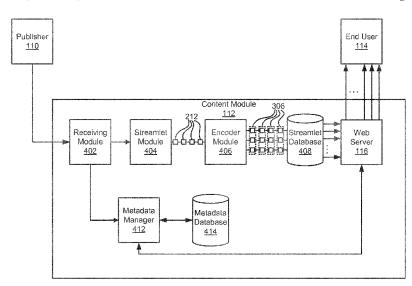
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Primary Examiner — Chirag R Patel (74) Attorney, Agent, or Firm — KW Law, LLP

# (57) ABSTRACT

An apparatus for multi-bitrate content streaming includes a receiving module configured to capture media content, a streamlet module configured to segment the media content and generate a plurality of streamlets, and an encoding module configured to generate a set of streamlets. The system includes the apparatus, wherein the set of streamlets comprises a plurality of streamlets having identical time indices and durations, and each streamlet of the set of streamlets having a unique bitrate, and wherein the encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. A method includes receiving media content, segmenting the media content and generating a plurality of streamlets, and generating a set of streamlets.

## 25 Claims, 11 Drawing Sheets



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# Related U.S. Application Data

continuation of application No. 16/004,056, filed on Jun. 8, 2018, now Pat. No. 10,659,513, which is a continuation of application No. 15/414,025, filed on Jan. 24, 2017, now Pat. No. 9,998,516, which is a continuation of application No. 14/719,122, filed on May 21, 2015, now Pat. No. 9,571,551, which is a continuation of application No. 14/106,051, filed on Dec. 13, 2013, now Pat. No. 9,071,668, which is a continuation of application No. 13/617,114, filed on Sep. 14, 2012, now Pat. No. 8,612,624, which is a continuation of application No. 12/906,940, filed on Oct. 18, 2010, now Pat. No. 8,402,156, which is a continuation of application No. 11/673,483, filed on Feb. 9, 2007, now Pat. No. 7,818,444, which is a continuation-in-part of application No. 11/116,783, filed on Apr. 28, 2005, now Pat. No. 8,868,772.

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                           (2011.01)
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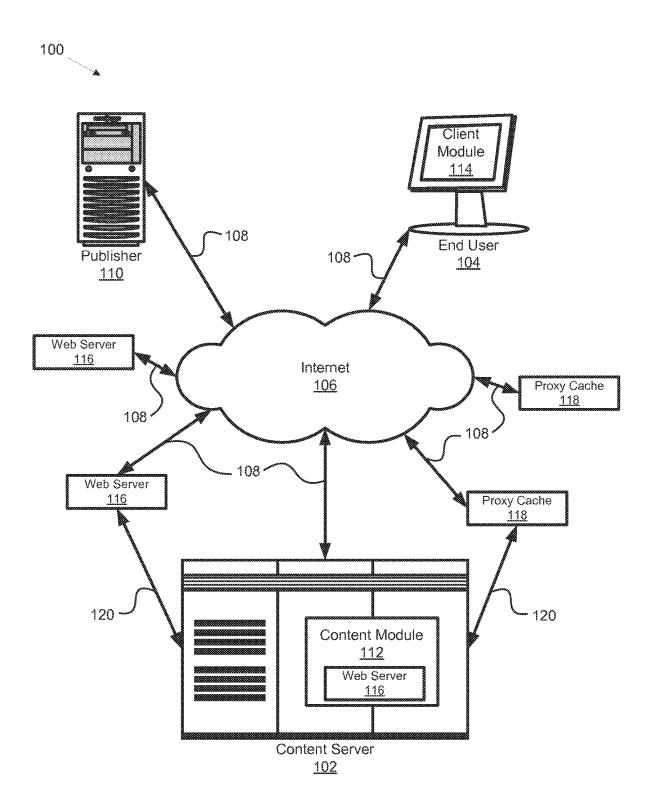


FIG. 1

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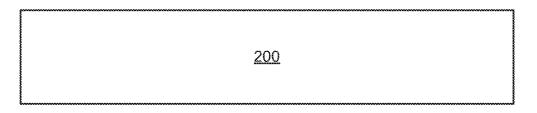


FIG. 2a

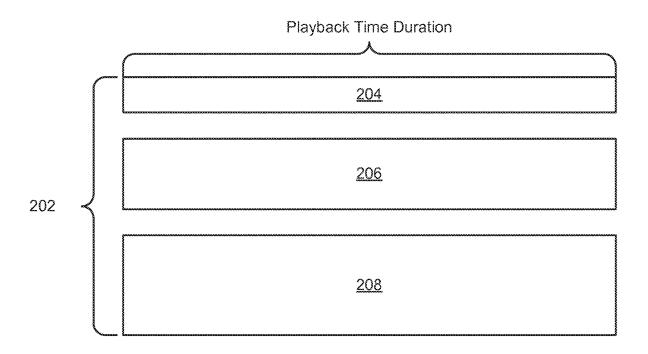


FIG. 2b

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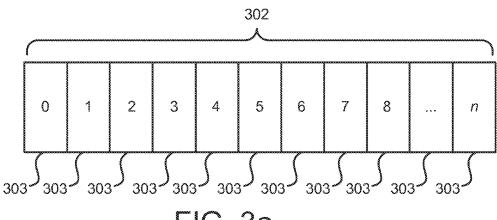


FIG. 3a

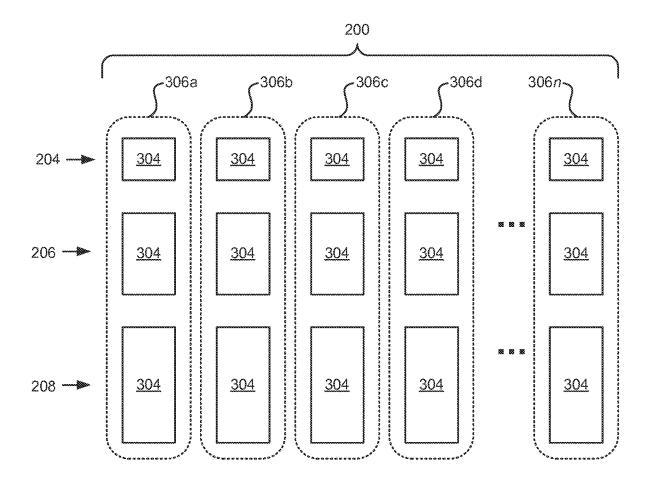
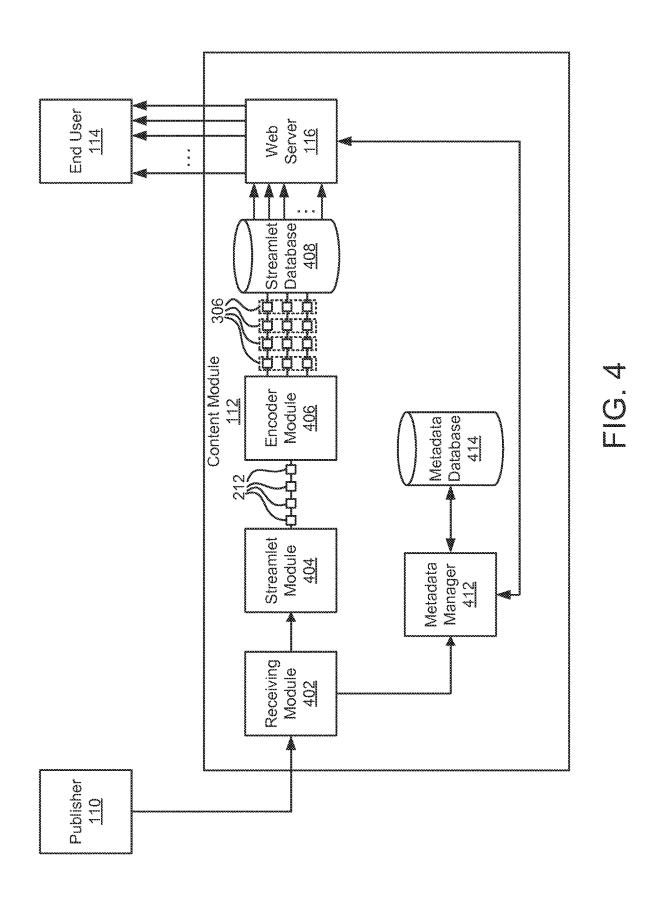


FIG. 3b

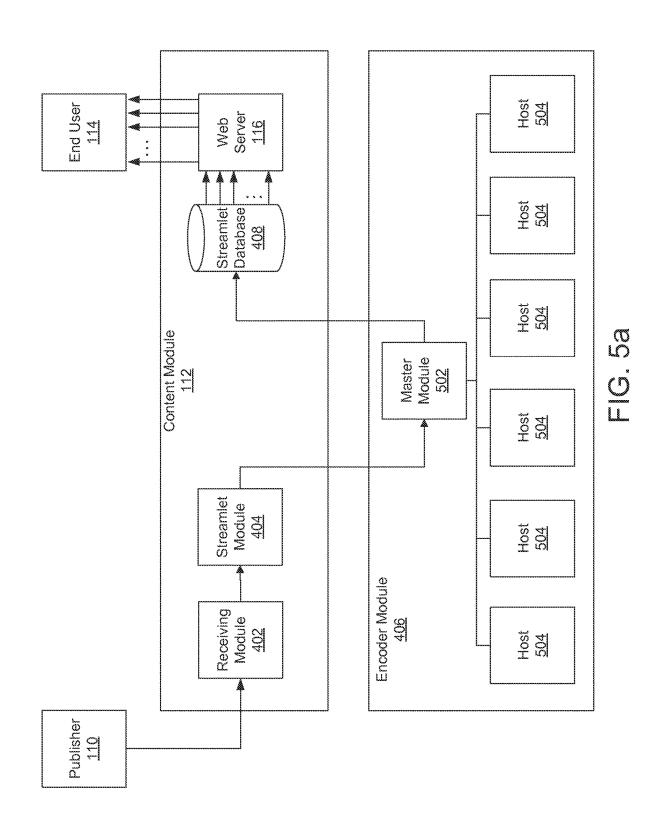
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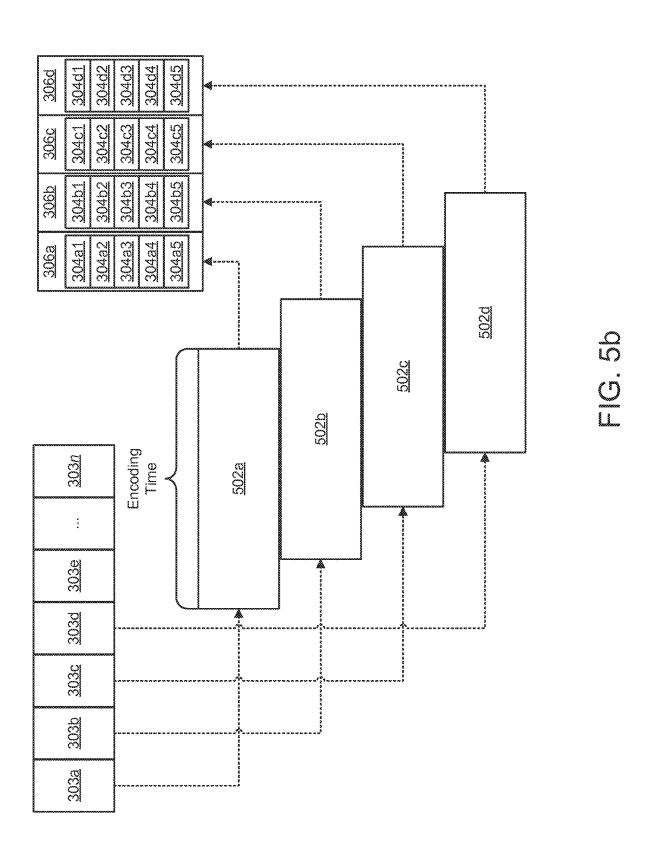
Jun. 13, 2023

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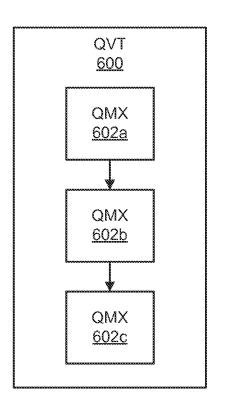


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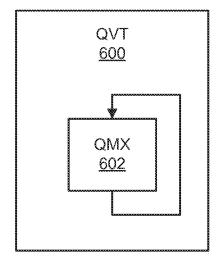


FIG. 6b

FIG. 6a

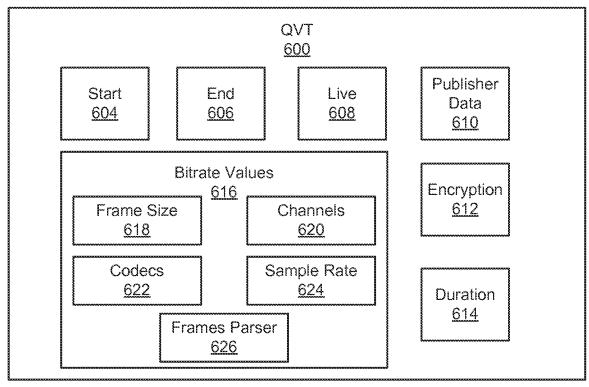
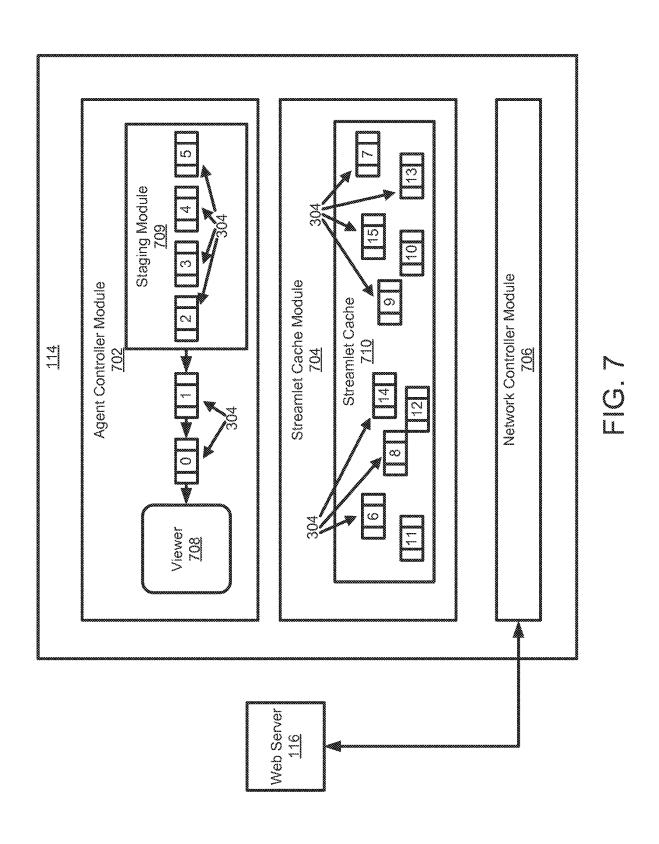


FIG. 6c

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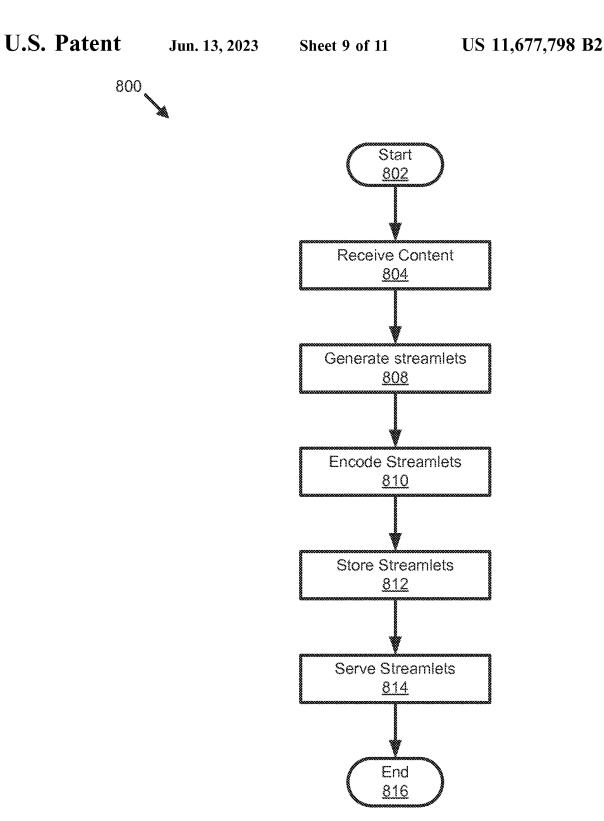


FIG. 8

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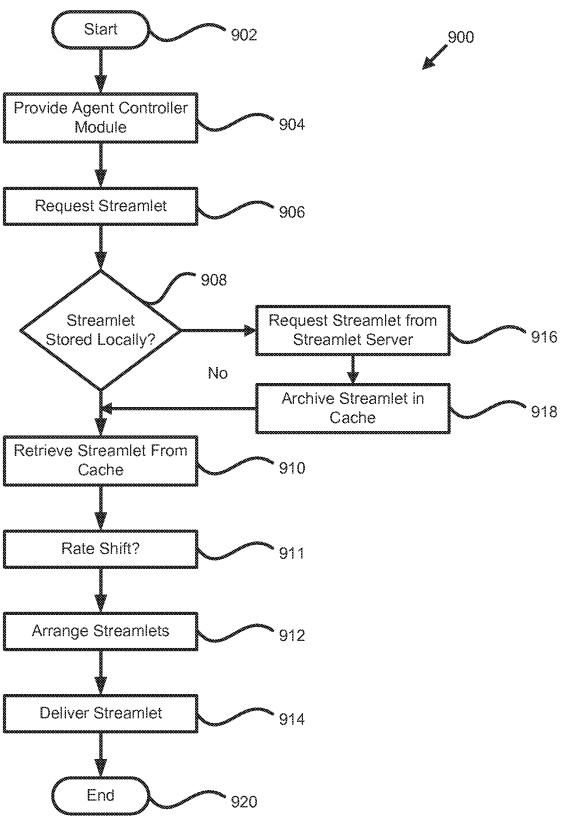
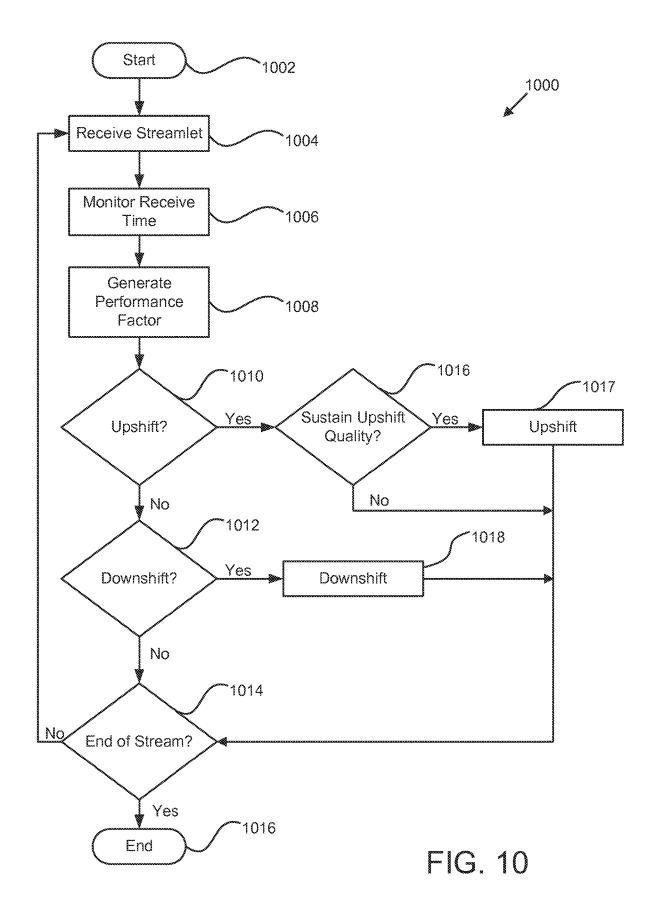


FIG. 9

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# 1 APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

# CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 16/876,579 filed on May 18, 2020 (now U.S. Pat. No. 11,470,138), which is a continuation of Ser. No. 16/004,056 filed on Jun. 8, 2018 (now U.S. Pat. No. 10,659, 10 513), which is a continuation of U.S. patent application Ser. No. 15/414,025 (now U.S. Pat. No. 9,998,516) filed on Jan. 24, 2017, which is a continuation of U.S. patent application Ser. No. 14/719,122 filed on May 21, 2015 (now U.S. Pat. No. 9,571,551), which is a continuation of U.S. patent 15 application Ser. No. 14/106,051 filed on Dec. 13, 2013 (now U.S. Pat. No. 9,071,668), which is a continuation of U.S. patent application Ser. No. 13/617,114, filed on Sep. 14, 2012 (now U.S. Pat. No. 8,612,624), which is a continuation of U.S. patent Ser. No. 12/906,940 filed on Oct. 18, 2010 20 (now U.S. Pat. No. 8,402,156), which is a continuation of U.S. patent application Ser. No. 11/673,483, filed on Feb. 9, 2007 (now U.S. Pat. No. 7,818,444), which is a continuation-in-part of application Ser. No. 11/116,783, filed on Apr. 28, 2005 (now U.S. Pat. No. 8,868,772), which claims the 25 benefit of U.S. Provisional Application No. 60/566,831, filed on Apr. 31, 2004, all of which are incorporated herein by reference.

### BACKGROUND OF THE INVENTION

# Field of the Invention

The invention relates to video streaming over packet switched networks such as the Internet, and more particularly relates to adaptive-rate shifting of streaming content over such networks.

# Description of the Related Art

The Internet is fast becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or practically any network capable device. Many portable media players are equipped with network connections and 45 enabled to play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a server.

"Streaming media" refers to technology that delivers 50 content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently deleted. The user has the immediate satisfaction of viewing the requested content without waiting for the media file to 55 completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network connection. Streaming may be used to deliver content on demand (previously recorded) or from live broadcasts.

Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media files can take large amounts of time depending on the network connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a

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higher quality audio/video than can be delivered in real time. Users generally dislike this option, as they tend to want to see or hear the media file instantaneously.

Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for viewing on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also vulnerable to network failures or congestion.

Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, 30 or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for a moment and then slowly resumes the original transmission pace. This behavior is an attempt to alleviate the perceived congestion. Such a slowdown is detrimental to the viewing or listening experience of the user and therefore is not acceptable.

The second challenge to data transport is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

The third challenge is latency. Latency is the time measure form the client's point-of-view, of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput of TCP.

From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would

utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

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# SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems. 10 Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the abovediscussed shortcomings in the art.

The apparatus for adaptive-rate content streaming is pro- 15 vided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include a receiving module configured to receive media content, a streamlet module configured to segment the media content 20 and generate a plurality of sequential streamlets, and an encoding module configured to encode each streamlet as a separate content file.

The encoding module is further configured to generate a set of streamlets for each of the sequential streamlets. Each 25 streamlet may comprise a portion of the media content having a predetermined length of time. The predetermined length of time may be in the range of between about 0.1 and 5 seconds.

In one embodiment, a set of streamlets comprises a 30 plurality of streamlets having identical time indices, and each streamlet of the set of streamlets has a unique bitrate. The receiving module is configured to convert the media content to raw audio or raw video. The encoding module may include a muster module configured to assign an 35 encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. The job completion bid may be based on a plurality of computing variables selected from a group consisting of current encoding job completion percentage, average encoding job 40 completion time, processor speed, and physical memory capacity.

A system of the present invention is also presented for adaptive-rate content streaming. In particular, the system, in one embodiment, includes a receiving module configured to 45 receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, each streamlet comprising a portion of the media content having a predetermined length of time, and an encoding module configured to encode each stream- 50 let as a separate content file and generate a set of streamlets.

The system also includes a plurality of streamlets having identical time indices and each streamlet of the set of streamlets having a unique bitrate. The encoding module comprises a master module configured to assign an encoding 55 trating one embodiment of a media content file; job to one of a plurality of host computing modules in response to an encoding job completion bid.

A method of the present invention is also presented for adaptive-rate content steaming. In one embodiment, the method includes receiving media content, segmenting the 60 media content and generating a plurality of sequential streamlets, and encoding each streamlet as a separate content

The method also includes segmenting the media content into a plurality of streamlets, each streamlet comprising a 65 portion of the media content having a predetermined length of time. In one embodiment, the method includes generating

a set of streamlets comprising a plurality of streamlets having identical time indices, and each streamlet of the set of streamlets having a unique bitrate.

Furthermore, the method may include converting the media content to raw audio or raw video, and segmenting the content media into a plurality of sequential streamlets. The method further comprises assigning an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid, and submitting an encoding job completion bid based on a plurality of computing

Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment.

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention.

These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

# BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

FIG. 1 is a schematic block diagram illustrating one embodiment of a system for dynamic rate shifting of streaming content in accordance with the present invention;

FIG. 2a is a schematic block diagram graphically illus-

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth;

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of source

FIG. 3b is a schematic block diagram illustrating one embodiment of sets of streamlets in accordance with the present invention;

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module in accordance with the present invention;

FIG. 5a is a schematic block diagram illustrating one embodiment of an encoder module in accordance with the present invention:

FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accor- 5 dance with the present invention;

FIG. 6a is a schematic block diagram illustrating one embodiment of a virtual timeline in accordance with the present invention;

FIG. 6b is a schematic block diagram illustrating an 10 alternative embodiment of a VT in accordance with the present invention:

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX in accordance with the present

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with the present invention;

FIG. 8 is a schematic flow chart diagram illustrating one embodiment of a method for processing content in accor- 20 dance with the present invention;

FIG. 9 is a schematic flow chart diagram illustrating one embodiment of a method for viewing a plurality of streamlets in accordance with the present invention; and

FIG. 10 is a schematic flow chart diagram illustrating one 25 embodiment of a method for requesting streamlets within an adaptive-rate shifting content streaming environment in accordance with the present invention.

# DETAILED DESCRIPTION OF THE INVENTION

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For 35 example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field 40 programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more 45 physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations 50 which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distribprograms, and across several memory devices. Similarly, operational data may be identified and illustrated herein within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may 60 be distributed over different locations including over different storage devices, and may exist, at least partially, merely as electronic signals on a system or network.

Reference throughout this specification to "one embodiment," "an embodiment," or similar language means that a 65 particular feature, structure, or characteristic described in connection with the embodiment is included in at least one

embodiment of the present invention. Thus, appearances of the phrases "in one embodiment." "in an embodiment," and similar language throughout this specification may, but do

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not necessarily, all refer to the same embodiment.

content streaming as described herein.

Reference to a signal bearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machinereadable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device. In one embodiment, a computer program product including a computer useable medium having a computer readable program of computer instructions stored thereon that when executed on a computer causes the computer to carry out operations for multi-bitrate

Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the inven-

FIG. 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user station 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured to present content. For example, portable electronic devices may include, but are not limited to, cellular phones, portable gaming systems, and portable computing devices.

In the depicted embodiment, the system 100 also includes uted over several different code segments, among different 55 a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For example, if the content to be streamed were a broadcast of a television program, the publisher 110 may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the Internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may be configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of locations

simultaneously. For example, the client module 114 may request and receive content from any of the plurality of web servers 116.

Content from the content server 102 may be replicated to other web servers 116 or alternatively to proxy cache servers 118. Replicating may occur by deliberate forwarding from the content server 102, or by a web, cache, or proxy server outside of the content server 102 asking for content on behalf of the client module 114. In a further embodiment, content may be forwarded directly to web 116 or proxy 118 servers through direct communication channels 120 without the need to traverse the Internet 106.

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content (hereinafter "content") file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Alternatively, the content file 200 may be compressed using standard or proprietary encoding schemes. Examples of encoding schemes capable of use with the present invention include, but are not limited to, DivX®, Windows Media 25 Video®, Quicktime Sorenson 3®, On2, OGG Vorbis, MP3, or Quicktime 6.5/MPEG-4® encoded content.

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the 30 plurality of streams 202 comprises a low quality stream 204, a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and 35 compressed to a bit rate of 100 kilobits per second (kbps), the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 208 may be encoded and compressed to 600 kbps.

FIG. 3a is a schematic block diagram illustrating one 40 embodiment of a stream 302 divided into a plurality or source streamlets 303. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 303 may comprise a portion of the content contained in stream 302, encapsulated as an independent media object. The 45 content in a streamlet 303 may have a unique time index in relation to the beginning of the content contained in stream 302. In one embodiment, the content contained in each streamlet 303 may have a duration of two seconds. For example, streamlet 0 may have a time index of 00:00 50 representing the beginning of content playback, and streamlet 1 may have a time index of 00:02, and so on. Alternatively, the time duration of the streamlets 304 may be any duration smaller than the entire playback duration of the content in stream 302. In a further embodiment, the stream- 55 lets 303 may be divided according to file size instead of a time index and duration.

FIG. 3b is a schematic block diagram illustrating one embodiment of sets 306 of streamlets in accordance with the present invention. As used herein, the term "set" refers to a 60 group of streamlets having identical time indices and durations but varying bitrates. In the depicted embodiment, the set 306a encompasses all streamlets having a time index of 00:00. The set 306a includes encoded streamlets 304 having low, medium, and high 204, 206, 208 bitrates. Of course 65 each set 306 may include more than the depicted three bitrates which are given by way of example only. One

8 skilled in the art will recognize that any number of streams having different bitrates may be generated from the original content 200.

As described above, the duration of one streamlet 304 may be approximately two seconds. Likewise each set 306 may comprise a plurality of streamlets 304 where each streamlet 304 has a playable duration of two seconds. Alternatively, the duration of the streamlet 304 may be predetermined or dynamically variable depending upon a variety of factors including, but not limited to, network congestion, system specifications, playback resolution and quality, etc. In the depicted embodiment, the content 200 may be formed of the plurality of sets 306. The number of sets 306 may depend on the length of the content 200 and the length or duration of each streamlet 304.

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 112 may comprise a capture module 402, a streamlet module 404, an encoder module 406, a streamlet database 408, and the web server 116. In one embodiment, the capture module 402 is configured to receive the content file 200 from the publisher 110. The capture module 402 may be configured to "decompress" the content file 200. For example, if the content file 200 arrives having been encoded with one of the above described encoding schemes, the capture module 402 may convert the content file 200 into raw audio and/or video. Alternatively, the content file 200 may be transmitted by the publisher in a format 110 that does not require decompression.

The capture module **402** may comprise a capture card configured for TV and/or video capture. One example of a capture card suitable for use in the present invention is the DRC-2500 by Digital Rapids of Ontario, Canada. Alternatively, any capture card capable of capturing audio and video may be utilized with the present invention. In a further embodiment, the capture module **402** is configured to pass the content file to the streamlet module **404**.

The streamlet module 404, in one embodiment, is configured to segment the content file 200 and generate source streamlets 303 that are not encoded. As used herein, the term "segment" refers to an operation to generate a streamlet of the content file 200 having a duration or size equal to or less than the duration or size of the content file 200. The streamlet module 404 may be configured to segment the content file 200 into streamlets 303 each having an equal duration. Alternatively, the streamlet module 404 may be configured to segment the content file 200 into streamlets 303 having equal file sizes.

The encoding module 406 is configured to receive the source streamlets 303 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in the art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

In a further embodiment, the encoding module 406 is configured to generate a plurality of sets 306 of streamlets 304. The sets 306, as described above with reference to FIG. 3b, may comprise streamlets having an identical time index and duration, and a unique bitrate. As with FIG. 3b, the sets 306 and subsequently the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively,

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the plurality of streams 202 may comprise any number of streams deemed necessary to accommodate end user bandwidth.

The encoder module 406 is further configured to encode each source streamlet 303 into the plurality of streams 202<sup>5</sup> and streamlet sets 306 and store the streamlets in the streamlet database 408. The encoding module 406 may utilize encoding schemes such as DivX®, Windows Media Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/ MPEG-4®. Alternatively, a custom encoding scheme may be employed.

The content module 112 may also include a metadata module 412 and a metadata database 414. In one embodiment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be configured to define an end user environment. In one embodiment, the publisher 100 may define an end user 20 306 to the master 502 so that the encoding module 406 may navigational environment for the content including menus, thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, pause, and play that may be used with the content file 200. The metadata module 412 is configured to receive the 25 metadata from the publisher 110 and store the metadata in the metadata database 414. In a further embodiment, the metadata module 412 is configured to interface with the client module 114, allowing the client module 114 to search for content based upon at least one of a plurality of metadata 30 criteria. Additionally, metadata may be generated by the content module 112 through automated process(es) or manual definition.

Once the streamlets 304 have been received and processed, the client module 114 may request streamlets 304 35 using HTTP from the web server 116. Using a standard protocol such as HTTP eliminates the need for network administrators to configure firewalls to recognize and pass through network traffic for a new, specialized protocol. Additionally, since the client module 114 initiates the 40 request, the web server 116 is only required to retrieve and serve the requested streamlet 304. In a further embodiment, the client module 114 may be configured to retrieve streamlets 304 from a plurality of web servers 116.

Each web server 116 may be located in various locations 45 across the Internet 106. The streamlets 304 may essentially be static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 304. Streamlets 304 may be served by the web server 116 or cached by cache servers of Internet 50 Service Providers (ISPs), or any other network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution is provided that is not hindered by massive amounts of client 55 module 114 requests to the web server 116 at any specific location, especially the web server 116 most closely associated with or within the content module 112

FIG. 5a is a schematic block diagram illustrating one embodiment of an encoder module 406 in accordance with 60 the present invention. In one embodiment, the encoder module 406 may include a master module 502 and a plurality of host computing modules (hereinafter "host") 504. The hosts 504 may comprise personal computers, servers, etc. In a further embodiment, the hosts 504 may be 65 dedicated hardware, for example, cards plugged into a single computer.

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The master module (hereinafter "master") 502 is configured to receive streamlets 303 from the streamlet module 404 and stage the streamlet 303 for processing. In one embodiment, the master 502 may decompress each source streamlet 303 to produce a raw streamlet. As used herein, the term "raw streamlet" refers to a streamlet 303 that is uncompressed or lightly compressed to substantially reduce size with no significant loss in quality. A lightly compressed raw streamlet can be transmitted more quickly and to more hosts. Each host 504 is coupled with the master 502 and configured to receive a raw streamlet from the master 502 for encoding. The hosts 504, in one example, generate a plurality of streamlets 304 having identical time indices and durations, and varying bitrates. Essentially each host 504 may be configured to generate a set 306 from the raw streamlet 503 sent from the master 502. Alternatively, each host 504 may be dedicated to producing a single bitrate in order to reduce the time required for encoding.

Upon encoding completion, the host 504 returns the set store the set 306 in the streamlet database 408. The master **502** is further configured to assign encoding jobs to the hosts 504. Each host is configured to submit an encoding job completion bid (hereinafter "bid"). The master 502 assigns encoding jobs depending on the bids from the hosts 504. Each host 504 generates a bid depending upon a plurality of computing variables which may include, but are not limited to, current encoding job completion percentage, average job completion time, processor speed and physical memory

For example, a host **504** may submit a bid that indicates that based on past performance history the host 504 would be able to complete the encoding job in 15 seconds. The master 502 is configured to select from among a plurality of bids the best bid and subsequently submit the encoding job to the host 504 with the best bid. As such, the described encoding system does not require that each host 504 have identical hardware but beneficially takes advantage of the available computing power of the hosts 504. Alternatively, the master 502 selects the host 504 based on a first come first serve basis, or some other algorithm deemed suitable for a particular encoding job.

The time required to encode one streamlet 304 is dependent upon the computing power of the host 504, and the encoding requirements of the content tile 200. Examples of encoding requirements may include, but are not limited to, two or multi-pass encoding, and multiple streams of different bitrates. One benefit of the present invention is the ability to perform two-pass encoding on a live content file 200. Typically, in order to perform two-pass encoding prior art systems must wait for the content file to be completed before encoding.

The present invention, however, segments the content file 200 into source streamlets 303 and the two-pass encoding to a plurality of streams 202 may be performed on each corresponding raw streamlet without waiting for a TV show to end, for example. As such, the content module 112 is capable of streaming the streamlets over the Internet shortly after the content module 112 begins capture of the content file 200. The delay between a live broadcast transmitted from the publisher 110 and the availability of the content depends on the computing power of the hosts 504.

FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention. In one example, the capture module 402 (of FIG. 4) begins to capture the content file and the streamlet module 404 generates a first streamlet

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303a and passes the streamlet to the encoding module 406. The encoding module 406 may take 10 seconds, for example, to generate the first set 306a of streamlets 304a (304a1, 304a2, 304a3, etc. represent streamlets 304 of different bitrates). FIG. 5b illustrates the encoding process 5 generically as block 502 to graphically illustrate the time duration required to process a raw or lightly encoded streamlet 303 as described above with reference to the encoding module 406. The encoding module 406 may simultaneously process more than one streamlet 303, and processing of 10 streamlets will begin upon arrival of the streamlet from the capture module 402.

During the 10 seconds required to encode the first streamlet 303a, the streamlet module 404 has generated five additional 2-second streamlets 303b, 303c, 303d, 303e, 303f, 15 for encoding and the master 502 has prepared and staged the corresponding raw streamlets. Two seconds after the first set 306a is available the next set 306b is available, and so on. As such, the content file 200 is encoded for streaming over the Internet and appears live. The 10 second delay is given 20 herein by way of example only. Multiple hosts 504 may be added to the encoding module 406 in order to increase the processing capacity of the encoding module 406. The delay may be shortened to an almost unperceivable level by the addition of high CPU powered systems, or alternatively 25 multiple low powered systems.

A system as described above beneficially enables multipass encoding of live events. Multi-pass encoding systems of the prior art require that the entire content be captured (or be complete) because in order to perform multi-pass encoding the entire content must be scanned and processed more than once. This is impossible with prior art systems because content from a live event is not complete until the event is over. As such, with prior art systems, multi-pass encoding can only be performed once the event is over. Streamlets, 35 however, may be encoded as many times as is deemed necessary. Because the streamlet is an encapsulated media object of 2 seconds (for example), multi-pass encoding may begin on a live event once the first streamlet is captured. Shortly after multi-pass encoding of the first streamlet 303a 40 is finished, multi-pass encoding of the second streamlet 303b finishes, and as such multi-pass encoding is performed on a live event and appears live to a viewer.

Any specific encoding scheme applied to a streamlet may take longer to complete than the time duration of the 45 streamlet itself, for example, a very high quality encoding of a 2-second streamlet may take 5 seconds to finish. Alternatively, the processing time required for each streamlet may be less than the time duration of a streamlet. However, because the offset parallel encoding of successive streamlets 50 are encoded by the encoding module at regular intervals (matching the intervals at which the those streamlets are submitted to the encoding module 406, for example 2 seconds) the output timing of the encoding module 406 does not fall behind the real-time submission rate of the unen- 55 coded streamlets. Conversely, prior art encoding systems rely on the very fastest computing hardware and software because the systems must generate the output immediately in lock-step with the input. A prior art system that takes 2.1 seconds to encode 2 seconds worth of content is considered 60 a failure. The present invention allows for slower than real-time encoding processes yet still achieves a real-time encoding effect due to the parallel offset pipes.

The parallel offset pipeline approach described with reference to FIG. 5b beneficially allows for long or short 65 encoding times without "falling behind" the live event. Additionally, arbitrarily complex encoding of streamlets to

multiple profiles and optimizations only lengthens the encoding time 502 without a perceptible difference to a user because the sets 306 of streamlets 304 are encoded in a time-selective manner so that streamlets are processed at regular time intervals and transmitted at these time intervals.

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Returning now to FIG. 5a, as depicted, the master 502 and the hosts 504 may be located within a single local area network, or in other terms, the hosts 504 may be in close physical proximity to the master 502. Alternatively, the hosts 504 may receive encoding jobs from the master 502 over the Internet or other communications network. For example, consider a live sports event in a remote location where it would be difficult to setup multiple hosts. In this example, a master performs no encoding or alternatively light encoding before publishing the streamlets online. The hosts 504 would then retrieve those streamlets and encode the streamlets into the multiple bitrate sets 306 as described above.

Furthermore, hosts 504 may be dynamically added or removed from the encoding module without restarting the encoding job and/or interrupting the publishing of streamlets. If a host 504 experiences a crash or some failure, its encoding work is simply reassigned to another host.

The encoding module 406, in one embodiment, may also be configured to produce streamlets that are specific to a particular playback platform. For example, for a single raw streamlet, a single host 504 may produce streamlets for different quality levels for personal computer playback, streamlets for playback on cell phones with a different, proprietary codec, a small video-only streamlet for use when playing just a thumbnail view of the stream (like in a programming guide), and a very high quality streamlet for use in archiving.

FIG. 6a is a schematic block diagram illustrating one embodiment of a virtual timeline 600 in accordance with the present invention. In one embodiment, the virtual timeline 600 comprises at least one quantum media extension 602. The quantum media extension (hereinafter "QMX") 602 describes an entire content file 200. Therefore, the virtual timeline (hereinafter "VT") 600 may comprise a file that is configured to define a playlist for a user to view. For example, the VT may indicate that the publisher desires a user to watch a first show QMX 602a followed by QMX 602b and QMX 602c. As such, the publisher may define a broadcast schedule in a manner similar to a television station.

FIG. 6b is a schematic block diagram illustrating an alternative embodiment of a VT 600 in accordance with the present invention. In the depicted embodiment, the VT 600 may include a single QMX 602 which indicates that the publisher desires the same content to be looped over and over again. For example, the publisher may wish to broadcast a never-ending infomercial on a website.

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX 602 in accordance with the present invention. In one embodiment, the QMX 602 contains a multitude of information generated by the content module 112 configured to describe the content file 200. Examples of information include, but are not limited to, start index 604, end index 606, whether the content is live 608, proprietary publisher data 610, encryption level 612, content duration 614 and bitrate values 616. The bitrate values 616 may include frame size 618, audio channel 620 information, codecs 622 used, sample rate 624, and frames parser 626.

A publisher may utilize the QVT 600 together with the QMX 602 in order to prescribe a playback order for users, or alternatively selectively edit content. For example, a publisher may indicate in the QMX 602 that audio should be

muted at time index 10:42 or video should be skipped for 3 seconds at time index 18:35. As such, the publisher may selectively skip offensive content without the processing

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requirements of editing the content.

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module 114 in accordance with the present invention. The client module 114 may comprise an agent controller module 702, a streamlet cache module 704, and a network controller module 706. In one embodiment, the agent controller module 702 is configured to interface with a viewer 708, and transmit streamlets 304 to the viewer 708. Alternatively, the agent controller module 702 may be configured to simply reassemble streamlets into a single file for transfer to an external device such as a portable video player.

In a further embodiment, the client module 114 may comprise a plurality of agent controller modules 702. Each agent controller module 702 may be configured to interface with one viewer 708. Alternatively, the agent controller module 702 may be configured to interface with a plurality 20 of viewers 708. The viewer 708 may be a media player (not shown) operating on a PC or handheld electronic device.

The agent controller module **702** is configured to select a quality level of streamlets to transmit to the viewer **708**. The agent controller module **702** requests lower or higher quality streams based upon continuous observation of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to FIG. **10**.

The agent controller module 702 may be configured to receive user commands from the viewer 708. Such commands may include play, fast forward, rewind, pause, and stop. In one embodiment, the agent controller module 702 requests streamlets 304 from the streamlet cache module 35 704 and arranges the received streamlets 304 in a staging module 709. The staging module 709 may be configured to arrange the streamlets 304 in order of ascending playback time. In the depicted embodiment, the streamlets 304 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 304 may 40 be identified with a unique filename.

Additionally, the agent controller module 702 may be configured to anticipate streamlet 304 requests and prerequest streamlets 304. By pre-requesting streamlets 304, the user may fast-forward, skip randomly, or rewind through 45 the content and experience no buffering delay. In a further embodiment, the agent controller module 702 may request the streamlets 304 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 702 may request 50 streamlets at any interval less than the length of the time index. This enables a "fast-start" capability with no buffering wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 702 may be configured to pre-request streamlets 304 55 corresponding to specified index points within the content or within other content in anticipation of the end user 104 selecting new content to view. In one embodiment, the streamlet cache module 704 is configured to receive streamlet 304 requests from the agent controller module 702. Upon 60 receiving a request, the streamlet cache module 704 first checks a streamlet cache 710 to verify if the streamlet 304 is present. In a further embodiment, the streamlet cache module 704 handles streamlet 304 requests from a plurality of agent controller modules 702. Alternatively, a streamlet 65 cache module 704 may be provided for each agent controller module 702. If the requested streamlet 304 is not present in

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the streamlet cache 410, the request is passed to the network controller module 706. In order to enable fast forward and rewind capabilities, the streamlet cache module 704 is configured to store the plurality of streamlets 304 in the streamlet cache 710 for a specified time period after the streamlet 304 has been viewed. However, once the streamlets 304 have been deleted, they may be requested again from the web server 116.

The network controller module 706 may be configured to receive streamlet requests from the streamlet cache module 704 and open a connection to the web server 116 or other remote streamlet 304 database (not shown). In one embodiment, the network controller module 706 opens a TCP/IP connection to the web server 116 and generates a standard HTTP GET request for the requested streamlet 304. Upon receiving the requested streamlet 304, the network controller module 706 passes the streamlet 304 to the streamlet cache module 704 where it is stored in the streamlet cache 710. In a further embodiment, the network controller module 706 is configured to process and request a plurality of streamlets 304 simultaneously. The network controller module 706 may also be configured to request a plurality of streamlets, where each streamlet 304 is subsequently requested in multiple parts.

In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 304 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates problems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 304. Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more useful and predictable timing.

In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by the client as a forward cache. By requesting more than one streamlet 304 at a time in a manner referred to as "parallel retrieval," or more than one part of a streamlet 304 at a time, efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 304 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection fail. Streamlet 304 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from falling into a slow-start or close mode. If the network controller module 706 has requested a streamlet 304 in multiple parts, with each part requested on mutually independent TCP/IP connections, the network controller module 706 reassembles the parts to present a complete streamlet 304 for use by all other components of the client module 114.

When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet 304. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet 304. If the first streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the redundant request response, the first request may be aborted.

Several streamlet 304 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This elimi-

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nates all but the first request latency. Because multiple responses are always being transmitted, the processing latency of each new streamlet 304 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious vulnerabilities. Transmission delays affect all of the responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

Multiple TCP connections may be opened between the client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while 15 maintaining the independence of each streamlet 304 request. Several streamlet 304 requests may be sent concurrently, with each request being sent on a mutually distinct TCP connection. This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple 20 responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does 25 not affect the transmission of other responses because each response occupies an independent TCP connection. Any transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding responses.

A single streamlet 304 request may be issued for an entire streamlet 304, or multiple requests may be issued, each for a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by 35 the client module 114 streamlet.

In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 40 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three streamlet 304 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other 45 words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses diminishes the net response time of the other three responses. The timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to main- 50 tain the proper balance of efficiency and response times.

The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and 55 912 the streamlets 304 into the proper order, and the agent methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof, of the illustrated method. Additionally, the format and symbols employed are provided to explain the logical steps of the method and are understood not to limit the scope of the 60 method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood not to limit the scope of the corresponding method. Indeed, some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumerated steps of the depicted method.

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Additionally, the order in which a particular method occurs may or may not strictly adhere to the order of the corresponding steps shown.

FIG. 8 is a schematic flow chart diagram illustrating one embodiment of a method 800 for processing content in accordance with the present invention. In one embodiment the method 800 starts 802, and the content module 112 receives 804 content from the publisher 110. Receiving content 804 may comprise receiving 804 a digital copy of the content file 200, or digitizing a physical copy of the content file 200. Alternatively, receiving 804 content may comprise capturing a radio, television, cable, or satellite broadcast. Once received 804, the streamlet module 404 generates 808 a plurality of source streamlets 303 each having a fixed duration. Alternatively, the streamlets 303 may be generated with a fixed file size.

In one embodiment, generating 808 streamlets comprises dividing the content file 200 into a plurality of two second streamlets 303. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202. The encoder module 406 then encodes 810 the streamlets 303 into sets 306 of streamlets 304, in a plurality of streams 202 according to an encoding scheme. The quality may be predefined, or automatically set according to end user bandwidth, or in response to pre-designated publisher guidelines

In a further embodiment, the encoding scheme comprises a proprietary codec such as WMV9®. The encoder module 406 then stores 812 the encoded streamlets 304 in the streamlet database 408. Once stored 812, the web server 116 may then serve 814 the streamlets 304. In one embodiment, serving 814 the streamlets 304 comprises receiving streamlet requests from the client module 114, retrieving the requested streamlet 304 from the streamlet database 408, and subsequently transmitting the streamlet 304 to the client module 114. The method 800 then ends 816.

FIG. 9 is a schematic flow chart diagram illustrating one embodiment of a method 900 for viewing a plurality of streamlets in accordance with the present invention. The method 900 starts and an agent controller module 702 is provided 904 and associated with a viewer 708 and provided with a staging module 709. The agent controller module 702 then requests 906 a streamlet 304 from the streamlet cache module 704. Alternatively, the agent controller module 702 may simultaneously request 906 a plurality of streamlets 304 the streamlet cache module 704. If the streamlet is stored 908 locally in the streamlet cache 710, the streamlet cache module 704 retrieves 910 the streamlet 304 and sends the streamlet to the agent controller module 702. Upon retrieving 910 or receiving a streamlet, the agent controller module 702 makes 911 a determination of whether or not to shift to a higher or lower quality stream 202. This determination will be described below in greater detail with reference to FIG.

In one embodiment, the staging module 709 then arranges controller module 702 delivers 914 the streamlets to the viewer 708. In a further embodiment, delivering 914 streamlets 304 to the end user comprises playing video and or audio streamlets on the viewer 708. If the streamlets 304 are not stored 908 locally, the streamlet request is passed to the network controller module 706. The network controller module 706 then requests 916 the streamlet 304 from the web server 116. Once the streamlet 304 is received, the network controller module 706 passes the streamlet to the streamlet cache module 704. The streamlet cache module 704 archives 918 the streamlet. Alternatively, the streamlet cache module 704 then archives 918 the streamlet and

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passes the streamlet to the agent controller module 702, and the method 900 then continues from operation 910 as described above.

Referring now to FIG. 10, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 1000 for requesting streamlets 304 within an adaptive-rate shifting content streaming environment in accordance with the present invention. The method 1000 may be used in one embodiment as the operation 911 of FIG. 9. The method **1000** starts and the agent controller module **702** receives 1004 a streamlet 304 as described above with reference to FIG. 9. The agent controller module 702 then monitors 1006 the receive time of the requested streamlet. In one embodiment, the agent controller module 702 monitors the time  $_{15}$ intervals  $\Delta$  between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given  $\Delta$  may vary substan- 20 tially from another. In order to compensate for this fluctuation, the agent controller module 702 calculates 1008 a performance ratio r across a window of n samples for streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation:

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}.$$

Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ratio r, the agent controller module 702 may calculate a 35 geometric mean, or alternatively an equivalent averaging algorithm, across a window of size m, and obtain a performance factor φ:

$$\varphi_{current} = \left(\prod_{j=1}^{m} r_j\right)^{\frac{1}{m}}$$

The policy determination about whether or not to upshift 45 **1010** playback quality begins by comparing  $\phi_{current}$  with a trigger threshold  $\Theta_{up}$ . If  $\phi_{current} \ge \Theta_{up}$ , then an up shift to the next higher quality stream may be considered 1016. In one embodiment, the trigger threshold  $\Theta_{up}$  is determined by a combination of factors relating to the current read ahead 50 margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 709 for presentation at the current playback time index), and a minimum safety margin. In one embodiment, the miniahead margin, the larger 9, is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 702 is able to sustain 1016 upshift quality, then the agent controller module **702** will upshift **1017** the quality and subsequently 60 request higher quality streams. The determination of whether use of the higher quality stream is sustainable 1016 is made by comparing an estimate of the higher quality stream's performance factor,  $\phi_{higher}$ , with  $\Theta_{up}$ . If  $\Phi_{higher} \ge \Theta_{up}$  then use of the higher quality stream is consid- 65 ered sustainable. If the decision of whether or not the higher stream rate is sustainable 1016 is "no." the agent controller

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module 702 will not attempt to upshift 1017 stream quality. If the end of the stream has been reached 1014, the method 1000 ends 1016.

If the decision on whether or not to attempt upshift **1010** is "no", a decision about whether or not to downshift 1012 is made. In one embodiment, a trigger threshold  $\Theta_{down}$  is defined in a manner analogous to  $\Theta_{up}$ . If  $\phi_{current} > \Theta_{down}$  then the stream quality may be adequate, and the agent controller module 702 does not downshift 1018 stream quality. However, if  $\phi_{\mathit{current}} \!\! \leq \!\! \Theta_{\mathit{down}},$  the agent controller module 702 does downshift 1018 the stream quality. If the end of the stream has not been reached 1014, the agent controller module 702 begins to request and receive 1004 lower quality streamlets and the method 1000 starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced by alternative streamlet monitoring solu-

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of 25 the claims are to be embraced within their scope.

What is claimed is:

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1. A system for adaptive-rate content streaming of digital content playable on one or more end user stations over the Internet, the system comprising:

at least one storage device storing digital content, the digital content encoded at a plurality of different bit rates creating a plurality of streams including a first bit rate stream, a second bit rate stream, and a third bit rate stream, wherein the first bit rate stream, the second bit rate stream, and the third bit rate stream each comprise a group of streamlets encoded at a respective one of the plurality of different bit rates, each group of streamlets comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the digital

wherein at least one of the first bit rate stream, the second bit rate stream, and the third bit rate stream is encoded at a bit rate of no less than 600 kbps; and

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first temporal portion of the digital content in each of the first bit rate stream, the second bit rate stream, and the third bit rate stream, and wherein the first streamlet of the first bit rate stream encodes the same first temporal portion of the digital content at a different bit rate than the first streamlet of the second bit rate stream and the first streamlet of the third bit rate

2. The system of claim 1, further comprising: a plurality mum safety margin may be 24 seconds. The smaller the read 55 of servers located at different locations across the Internet, each server configured to: receive at least one streamlet request over one or more network connections from one or more end user stations to retrieve the first streamlet storing a portion of the digital content, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the first bit rate stream, the second bit rate stream, and the third bit rate stream based upon a determination by the end user station to select a higher or lower bit rate copy of the streams; retrieve from the at least one storage device the requested first streamlet from the currently selected one of the first bit rate stream, the second bit 19

rate stream, and the third bit rate stream; and send the retrieved first streamlet from the currently selected one of the different copies to the requesting one of the end user stations over the one or more network connections.

- 3. The system of claim 2, wherein the second streamlet of 5 each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the digital content in the first bit rate stream, the second bit rate stream, and the third bit rate stream, the second streamlet of the first bit rate stream having the same bit rate as the first 10 streamlet of the first bit rate stream.
- **4**. The system of claim **3**, wherein the first and second durations are different.
- 5. The system of claim 1, further comprising: a first server configured to: receive at least one streamlet request over one 15 or more network connections from the one or more end user stations to retrieve the first streamlet storing the first temporal portion of the digital content, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet 20 from one of the first bit rate stream, the second bit rate stream, and the third bit rate stream based upon a determination by the end user station to select a higher or lower bit rate copy of the digital content; retrieve from the at least one storage device the requested first streamlet from the cur- 25 rently selected one of the first bit rate stream, the second bit rate stream, and the third bit rate stream; and send the retrieved first streamlet from the currently selected one of the first bit rate stream, the second bit rate stream, and the third bit rate stream to the requesting one of the end user 30 stations over the one or more network connections.
- **6.** The system of claim **5**, wherein the digital content comprises a live event video of a live event, and the first streamlets of the first bit rate stream, the second bit rate stream, and the third bit rate stream are available before the 35 live event is complete.
- 7. The system of claim 6, wherein the streamlets from the first bit rate stream, the second bit rate stream, and the third bit rate stream of the live event, when played back, are presented in a live stream to a viewer.
- 8. The system of claim 7, wherein the first server is further configured to: receive at least one virtual timeline request over the one or more network connections from the one or more end user stations to retrieve a virtual timeline; and send the virtual timeline to the requesting one of the end user 45 stations over the one or more network connections.
  - 9. The system of claim 1, further comprising:
  - an encoding module configured to receive the digital content and encode the streamlets of the first bit rate.
- 10. The system of claim 9, wherein the encoding module 50 is configured to encode the streamlets of the multiple copies of the digital content in each of the different bit rates using a multi-pass encoding process.
  - 11. An end user station comprising:
  - a processor:
  - a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed, cause the processor to:
    - establish one or more network connections between the end user station and at least one server, wherein the 60 at least one server is configured to access at least one of a plurality of groups of streamlets of digital content;
    - wherein the digital content is encoded at a plurality of different bit rates to create a plurality of streams 65 including at least a first bit rate stream, a second bit rate stream, and a third bit rate stream, wherein each

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of the first bit rate stream, the second bit rate stream, and the third bit rate stream comprises a group of streamlets encoded at the same respective one of the different bit rates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the digital content;

wherein at least one of the first bit rate stream, the second bit rate stream, and the third bit rate stream is encoded at a bit rate of no less than 600 kbps; and wherein the first streamlets of each of the first bit rate

stream, the second bit rate stream and the third bit rate stream each has an equal playback duration and each of the first streamlets encodes the same portion of the digital content at a different one of the different bit rates;

determine whether to select a higher or lower bit rate copy of the stream and based on that determination, select a specific one of the first bit rate stream, the second bit rate stream, and the third bit rate stream; place a first streamlet request to the at least one server

place a first streamlet request to the at least one server over the one or more network connections for the first streamlet of the selected stream;

receive the requested first streamlet from the at least one server via the one or more network connections; and

provide the received first streamlet for output of the digital content to a presentation device.

- 12. The end user station of claim 11, wherein the non-transitory machine-readable instructions further comprise instructions that cause the processor to:
  - place a second streamlet request to the at least one server over the one or more network connections for the second streamlet of the selected stream;
  - receive the requested second streamlet from the at least one server via the one or more network connections;
  - arrange the first streamlet and second streamlet in order of ascending presentation time for output of the digital content to the presentation device.
- 13. The end user station of claim 11, wherein at least some streamlets are requested from the at least one server via a hypertext transfer protocol (HTTP) GET request.
- 14. The end user station of claim 11, wherein the at least one server comprises at least two servers and wherein at least one streamlet is requested from a first server of the at least one server and at least one other streamlet is requested from a second server of the at least one server other than the first server.
- 15. The end user station of claim 11, wherein each of the streamlets is requestable by the processor without regard to whether the processor has previously requested other streamlets of the digital content.
- **16**. The end user station of claim **11**, wherein at least a plurality of streamlets are separate files stored by the at least one server.
- 17. The end user station of claim 11, wherein the non-transitory machine-readable instructions further comprise instructions that cause the processor to:
  - place a second streamlet request to the at least one server over the one or more network connections for a second streamlet of a different bit rate stream, wherein the different bit rate stream comprises a different stream than the selected stream;

receive the requested second streamlet from the at least one server via the one or more network connections; 21

arrange the first streamlet and second streamlet in order of ascending presentation time for output of the digital content to the presentation device.

**18**. The end user station of claim **16**, wherein the non-transitory machine-readable instructions further comprise 5 instructions that cause the processor to:

determine an anticipated inability to receive the digital content at the second bit rate of the second bit rate stream at a rate sufficient for presenting the digital content as the digital content is received, and in 10 response to the determining the anticipated inability, requesting a third streamlet of the first bit rate stream, the third streamlet immediately subsequently adjacent to the second streamlet of the digital content during presentation.

- 19. The end user station of claim 18, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the digital content in the first bit rate stream, the second bit rate stream, and the third bit rate stream, the 20 second streamlet of the first bit rate stream having the same bit rate as the first streamlet of the first bit rate stream.
- 20. The end user station of claim 12, wherein the streamlets of the first bit rate stream, the second bit rate stream, and the third bit rate stream of the live event are available on a 25 ten second delay.
- 21. The end user station of claim 12, wherein the processor providing the first received streamlet for playback comprises outputting the first streamlet to a presentation device connected to the end user station.
- **22.** A process executable by one or more servers to stream digital content for playback by one or more end user stations, the process comprising:

storing, by the one or more servers, a plurality of streams including a first bit rate stream, a second bit rate stream, 35 and a third bit rate stream, wherein the first bit rate stream, the second bit rate stream, and the third bit rate stream each comprise a group of streamlets encoded at a respective one of a plurality of different bit rates, each group comprising at least first and second streamlets, 40 each of the streamlets corresponding to a portion of the digital content;

wherein at least one of the first bit rate stream, the second bit rate stream, and the third bit rate stream is encoded at a bit rate of no less than 600 kbps; and 22

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first temporal portion of the digital content in the first bit rate stream, the second bit rate stream, and the third bit rate stream, the first streamlet of the first bit rate stream having a different one of the different bit rates than the first streamlet of the second bit rate stream and the first streamlet of the third bit rate stream;

receiving at least one streamlet request over one or more network connections from the one or more end user stations to retrieve the first streamlet storing the first temporal portion of the digital content, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the first bit rate stream, the second bit rate stream, and the third bit rate stream based upon a determination by the end user station to select a higher or lower bit rate copy of the digital content:

retrieving from the storage device the requested first streamlet from the currently selected one of the first bit rate stream, the second bit rate stream, and the third bit rate stream; and

sending the retrieved first streamlet from the currently selected one of the first bit rate stream, the second bit rate stream, and the third bit rate stream to the requesting one of the end user stations over the one or more network connections.

- 23. The method of claim 22, wherein a second streamlet of each of the groups of streamlets each has a same second duration and corresponds to a same second temporal portion of the digital content in the first bit rate stream, the second bit rate stream, and the third bit rate stream, the second streamlet of the first bit rate stream having the same bit rate as the first streamlet of the first bit rate stream.
- 24. The method of claim 23, wherein the first and second durations are different.
- 25. The method of claim 22, wherein the digital content is a live event, and wherein the first streamlets of the first bit rate stream, the second bit rate stream, and the third bit rate stream are available before the live event is complete.

\* \* \* \* \*

# EXHIBIT C



# (12) United States Patent Major et al.

STREAMING CONTENT

# (54) APPARATUS, SYSTEM, AND METHOD FOR ADAPTIVE-RATE SHIFTING OF

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(52) U.S. Cl. CPC ...... H04L 47/25 (2013.01); H04L 65/60 (2013.01); H04N 21/25808 (2013.01);

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None

See application file for complete search history.

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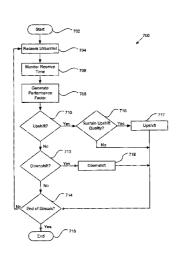
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#### (57)ABSTRACT

An apparatus for adaptive-rate shifting of streaming content includes an agent controller module configured to simultaneously request at least portions of a plurality of streamlets. The agent controller module is further configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or lower quality streamlets. A staging module is configured to stage the streamlets and arrange the streamlets for playback on a content player. A system includes a data communications network, a content server coupled to the data communications network and having a content module configured to process content and generate a plurality of high and low quality streams, and the apparatus. A method includes simultaneously requesting at least portions of a plurality of streamlets, continuously monitoring streamlet requests and subsequent responses, and accordingly requesting higher or lower quality streamlets, and staging the streamlets and arranging the streamlets for playback on a content player.

# 16 Claims, 7 Drawing Sheets



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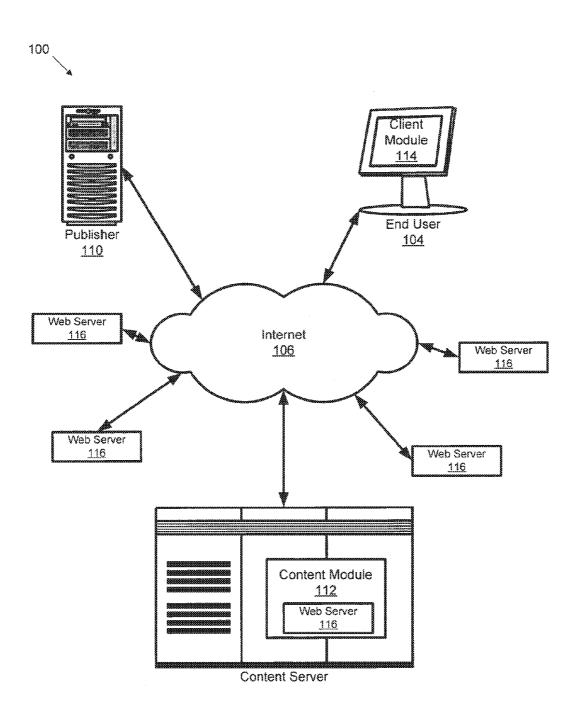


FIG. 1

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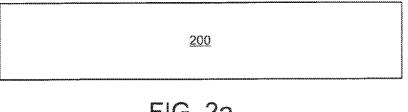


FIG. 2a

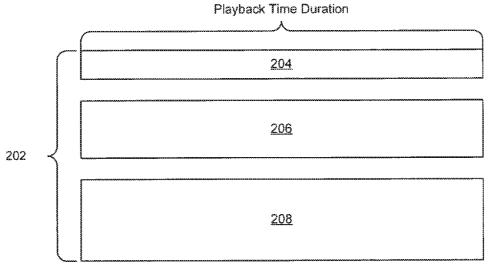


FIG. 2b

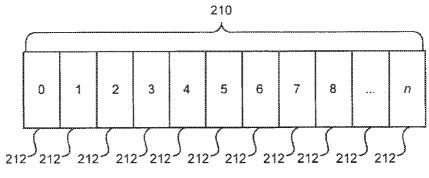
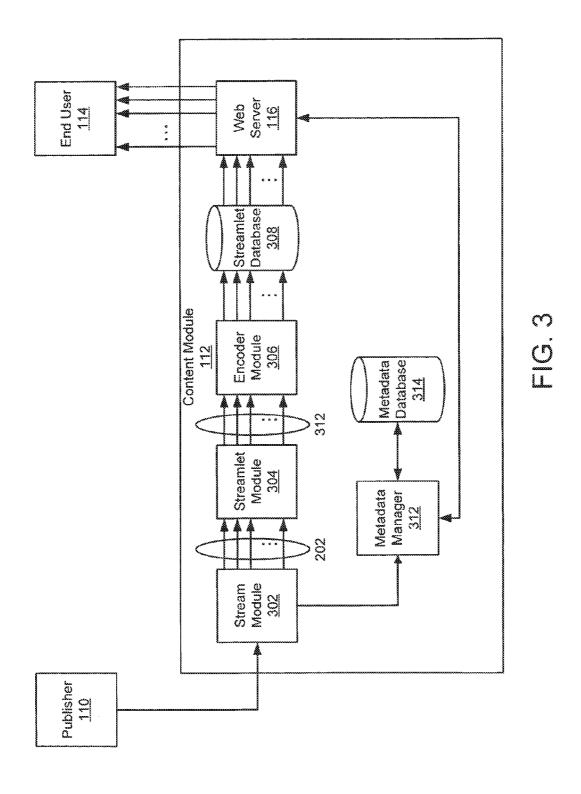


FIG. 2c

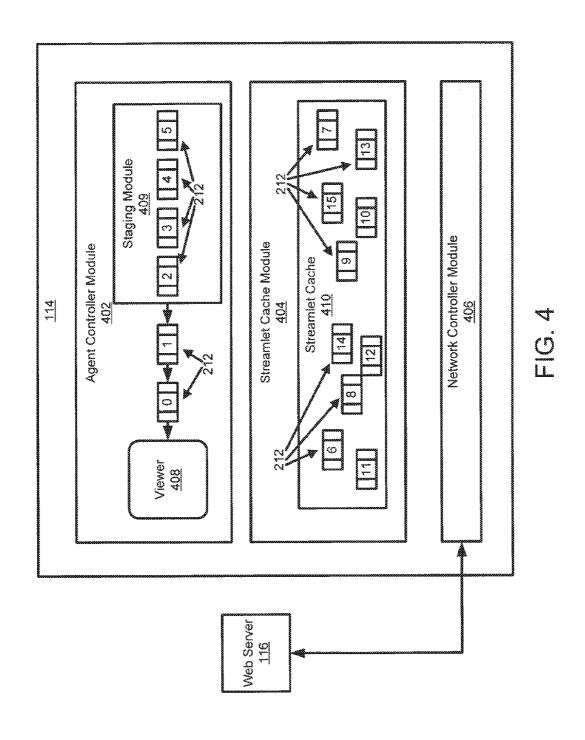
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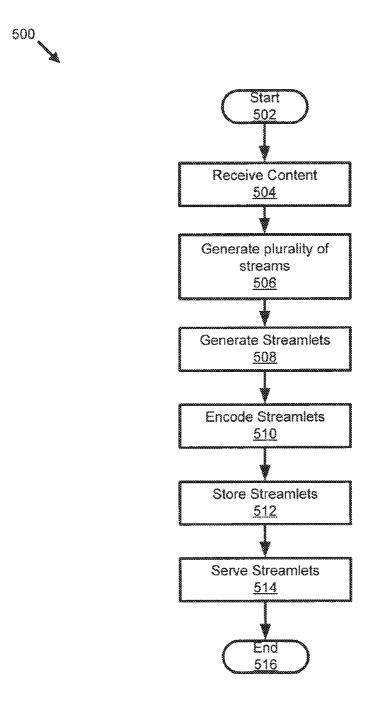


FIG. 5

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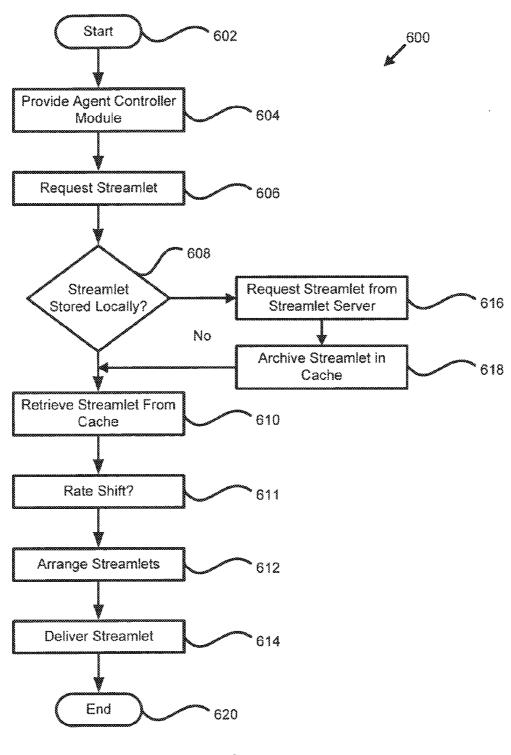
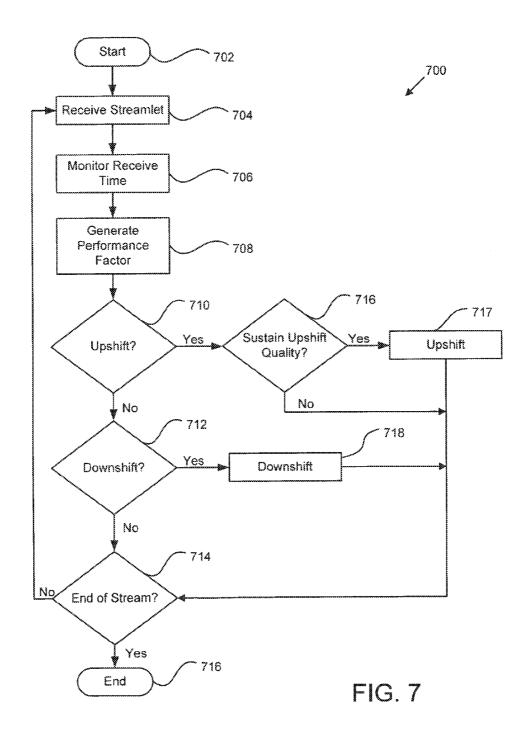


FIG. 6

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# APPARATUS, SYSTEM, AND METHOD FOR ADAPTIVE-RATE SHIFTING OF STREAMING CONTENT

# CROSS-REFERENCES TO RELATED APPLICATIONS

This application claims benefit of U.S. Provisional Patent Application No. 60/566,831 entitled "APPARATUS, SYSTEM, AND METHOD FOR DYNAMIC RATE SHIFTING 10 OF STREAMING CONTENT" and filed on Apr. 30, 2004 for R. Drew Major and Mark B. Hurst, which is incorporated herein by reference.

# BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The invention relates to video streaming over packet switched networks such as the Internet, and more particularly relates to adaptive-rate shifting of streaming content over 20 such networks.

# 2. Description of the Related Art

The Internet is last becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or practically any network capable device. Many portable media players are equipped with network connections and enabled to play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a server.

"Streaming media" refers to technology that delivers content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently deleted. The user has the immediate satisfaction of viewing the requested 35 content without wading for the media file to completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network connection. Streaming may be used to deliver content on demand (previously 40 recorded) or from live broadcasts.

Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media files can take large amounts of time depending on the network 45 connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a higher quality audio/video than can be delivered in real time. Users generally dislike this option, as they tend to want to see or hear the 50 media file instantaneously.

Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for viewing 55 on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also 60 vulnerable to network failures or congestion.

Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will

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be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the 15 data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for a moment and then slowly resumes the original transmission pace. This behavior is an attempt to alleviate the perceived congestion. Such a slowdown is detrimental, to the viewing or listening experience of the user and therefore is not acceptable.

The second challenge to data transport Is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

The third challenge is latency. Latency is the time measure form the client's point-of-view of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput of TCP.

From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

# SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems. Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the abovediscussed shortcomings in the art.

The apparatus for adaptive-rate content streaming is provided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include an agent controller module configured to simultaneously request a plurality of streamlets, the agent controller module further configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or

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lower quality streamlets, and a staging module configured to stage the streamlets and arrange the streamlets for playback on a content player.

The apparatus is further configured, in one embodiment, to establish multiple Transmission Control Protocol (TCP) connections with a content server, and request streamlets of varying bitrates. Each streamlet may further comprise a portion of a content file. Additionally, the agent controller module may be configured to generate a performance factor according to responses from streamlet requests.

In a further embodiment, the agent controller module is configured to upshift to a higher quality streamlet when the performance factor is greater than a threshold, and the agent controller module determines the higher quality playback can be sustained according to a combination of factors. The factors may include an amount of contiguously available streamlets stored in the staging module, a minimum safety margin, and a current read, ahead margin.

The agent controller module may be configured to down- 20 shift to a lower quality streamlet when the performance factor is less than a second threshold. Also, the agent controller module is further configured to anticipate streamlet requests and pre-request streamlets to enable fast-forward, skip randomly, and rewind functionality. In one embodiment, the 25 agent controller module is configured to initially request low quality streamlets to enable instant playback of the content file, and subsequent upshifting according to the performance factor.

A system of the present invention is also presented to 30 adaptive-rate content streaming. In particular, the system, in one embodiment, includes a data communications network, and a content server coupled to the data communications network and having a content module configured to process streams. In one embodiment, each of the high and low quality streams may include a plurality of streamlets.

In a further embodiment, the system also includes an agent controller module configured to simultaneously request a plurality of streamlets, the agent controller module further 40 configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or lower quality streamlets, and a staging module configured to stage the streamlets and arrange the streamlets for playback on a content player.

A method of the present invention is also presented for adaptive-rate content streaming. The method in the disclosed embodiments substantially includes the steps necessary to carry out the functions presented above with respect to the operation of the described apparatus and system. In one 50 embodiment, the method includes simultaneously requesting a plurality of streamlets, continuously monitoring streamlet requests and subsequent responses, and accordingly requesting higher or lower quality streamlets, and staging the streamlets and arranging the streamlets for playback on a content 55 player.

In a further embodiment, the method may include establishing multiple Transmission Control Protocol (TCP) connections with a content server, and requesting streamlets of varying nitrates. Also, the method may include generating & 60 performance factor according to responses from streamlet requests, upshifting to a higher quality streamlet when the performance factor is greater than a threshold, and determining if the higher quality playback can be sustained. Furthermore, the method may include downshifting to a lower qual- 65 ity streamlet when the performance factor is less than a second threshold.

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In one embodiment, the method includes anticipating streamlet requests and pre-requesting streamlets to enable fast-forward, skip randomly, and rewind functionality. The method may also comprise initially requesting low quality streamlets to enable instant playback of a content file, and subsequent upshifting according to the performance factor.

Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment.

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention.

These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

### BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily content and generate a plurality of high and low quality 35 understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which;

> FIG. 1 is a schematic block diagram illustrating one embodiment of a system for adaptive rate shifting of streaming content in accordance with the present invention;

> FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a content file in accordance with the present invention:

> FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth in accordance with the present invention;

> FIG. 2c is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of streamlets in accordance with the present invention;

> FIG. 3 is a schematic block diagram illustrating one embodiment of a content module in accordance with die present invention;

> FIG. 4 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with the present invention;

> FIG. 5 is a schematic flow chart diagram illustrating one embodiment of a method for processing content in accordance with the present invention;

> FIG. 6 is a schematic flow chart diagram illustrating one embodiment of a method for playback of a plurality of streamlets in accordance with the present invention; and

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FIG. 7 is a schematic flow chart diagram illustrating one embodiment of a method for requesting streamlets within an adaptive-rate content streaming environment in accordance with the present invention.

# DETAILED DESCRIPTION OF THE INVENTION

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise 25 disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed 30 over several different code segments, among different programs, and across several, memory devices. Similarly, operational data may be identified and illustrated herein within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The 35 operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely as electronic signals on a system or network.

Reference throughout this specification to "one embodiment," "an embodiment," or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and 45 similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

Reference to a signal hearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machine-readable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device. 55

Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known

6 structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

FIG. 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured to present content.

In the depicted embodiment, the system 100 also includes a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For example, it the content to be streamed were a broadcast of a television program, the publisher may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may fee configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of locations simultaneously. For example, the client module 114 may request and receive content horn any of the plurality of web servers 116.

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a content file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Additionally, the content file 200 may be compressed. Examples of a compressed content file 200 include, but are not limited to, DivX®, Windows Media Video 98®, Quicklime 6.5 Sorenson 3®, or Quicklime 6.5/MPEG-4® encoded content.

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the plurality of streams 202 comprises a low quality stream 204, a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and compressed to a bit rate of 100 kilobits per second (kbps), the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 208 may be encoded and compressed to 600 kbps.

FIG. 2c is a schematic block diagram illustrating one embodiment of a stream 210 divided into a plurality of streamlets 212. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 212 may comprise a portion of the content contained in stream 210, encapsulated as an independent media object. The content in a streamlet 212 may have a unique time index in relation to the beginning of the content contained in stream 210. In one embodiment, the content contained in each streamlet 212 has a duration of two seconds. For example, streamlet 0 may have

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a time index of 00:00 representing the beginning of content playback, and streamlet 1 may have a time index of 00:02, and so on. Alternatively, the time duration of the streamlets 212 may be any duration smaller than the entire playback duration of the content in stream 210. In a further embodiment, the streamlets 212 may be divided according to file size instead of a time index.

FIG. 3 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 112 may comprise a stream module 302, a streamlet module 304, an encoder module 306, a streamlet database 308, and the web server 116. In one embodiment, the stream module 302 is configured to receive the content file 200 from the publisher 110 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in the 20 art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

In the depicted embodiment, the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively, the 25 plurality of streams 202 may comprise any number of streams deemed necessary to accommodate end user bandwidth. The streamlet module 304 may be configured to receive the plurality of streams 202 from the stream module and generate a plurality of streams 312, each stream comprising a plurality 30 of streamlets 212. As described with reference to FIG. 2c, each streamlet 212 may comprise a pre-defined portion of the stream. The encoder module 306 is configured to encode each streamlet from the plurality of streams 312 and store the streamlets in the streamlet database 308. The encoding module 306 may utilize encoding schemes such as DivX®, Windows Media Video 9®, Quicklime 6.5 Sorenson 3®, or Quicklime 6.5/MPEG-4®. Alternatively, a custom encoding scheme may be employed.

The content module 112 may also include a metadata module 312 and a metadata database 314. In one embodiment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be 45 configured to define an end user environment. In one embodiment, the publisher 100 may define an end user navigational environment for the content including menus, thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, cause, and 50 play that may be used with the content file 200. The metadata module 312 is configured to receive the metadata from the publisher 110 and store the metadata in the metadata database **314**. In a further embodiment, the metadata module **312** is configured to interface with the client module 114, allowing 55 the client module 114 to search for content based upon at least one of a plurality of metadata criteria. Additionally, metadata may be generated by the content module 112 through automated process(es) or manual definition.

Once the streamlets 212 have been received and processed, 60 the client module 114 may request streamlets 212 using HTTP from the web server 116. Such use of client side initiated requests requires no additional configuration of firewalls. Additionally, since the client module 114 initiates the request, the web server 116 is only required to retrieve and 65 serve the requested streamlet. In a further embodiment, the client module 114 may be configured to retrieve streamlets

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212 from a plurality of web servers 310. Each web server 116 may be located in various locations across the Internet 106. The streamlets 212 are essentially static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 212. Streamlets 212 may be served by the web server 116 or cached by cache servers of Internet Service Providers (ISPs), or any other network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution is provided that is not hindered by massive amounts of client module 114 requests to the web server 116 at any specific location.

FIG. 4 is a schematic block diagram graphically illustrating one embodiment of a client module 114 in accordance with the present invention. The client module 114 may comprise an agent controller module 402, a streamlet cache module 404, and a network controller module 406. In one embodiment, the agent controller module 402 is configured to interface with a viewer 408, and transmit streamlets 212 to the viewer 408, In a further embodiment, the client module 114 may comprise a plurality of agent controller modules 402. Each agent controller module 402 may be configured to interface with one viewer 408. Alternatively, the agent controller module 402 may be configured to interface with a plurality of viewers 408. The viewer 408 may be a media player (not shown) operating on a PC or handheld electronic device.

The agent controller module **402** is configured to select a quality level of streamlets to transmit to the viewer **408**. The agent controller module **402** requests lower or higher quality streams based upon continuous observation, of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to FIG. **7**.

The agent controller module 402 may be configured to receive user commands from the viewer 408. Such commands may include play, fast forward, rewind, pause, and stop. In one embodiment, the agent controller module 402 requests streamlets 212 from the streamlet cache module 404 and arranges the received streamlets 212 in a staging module 409. The staging module 409 may fee configured to arrange the streamlets 212 in order of ascending playback time. In the depleted embodiment, the streamlets 212 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 212 may be identified with a unique filename.

Additionally, the agent controller module 402 may be configured to anticipate streamlet 212 requests and pre-request streamlets 212. By pro-requesting streamlets 212, the user may fast-forward, skip randomly, or rewind through the content and experience no buffering delay. In a further embodiment, the agent controller module 402 may request the streamlets 212 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 402 may request streamlets at any interval less than the length of the time index. This enables a "fast-start" capability with no buffering wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 402 may be configured to pre-request streamlets 212 corresponding to specified Index points within the content or within other content in anticipation of the end user 104 selecting new content to view.

In one embodiment, the streamlet cache module 404 is configured to receive streamlet 212 requests from the agent controller module 402. Upon receiving a request, the streamlet cache module 404 first checks a streamlet cache 410 to verify if the streamlet 212 is present. In a further embodiment,

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the streamlet cache module 404 handles streamlet 212 requests from a plurality of agent controller modules 402. Alternatively, a streamlet cache module 404 may be provided for each agent controller module 402. If the requested streamlet 212 is not present m the streamlet cache 410, the request is passed to the network controller module 406. In order to enable last forward and rewind capabilities, the streamlet cache module 404 is configured to store the plurality of streamlets 212 in the streamlet cache 410 for a specified time period after the streamlet 212 has been viewed. However, once the streamlets 212 have been deleted, they may be requested again from the web server 116.

The network controller module **406** may be configured to receive streamlet requests from the streamlet cache module **404** and open a connection to the web server **116** or other remote streamlet **212** database (not shown). In one embodiment, the network controller module **406** opens a TCP/IP connection to the web server **116** and generates a standard HTTP GET request for the requested streamlet **212**. Upon receiving the requested streamlet **212**, the network controller module **406** passes the streamlet **212** to the streamlet cache module **404** where it is stored in the streamlet cache **410**. In a further embodiment, the network controller module **406** is configured to process and request a plurality of streamlets **212** 25 simultaneously. The network controller module **406** may also be configured to request a plurality of streamlets, where each streamlet **212** is subsequently requested in multiple parts.

In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 30 212 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates problems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 212. 35 Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more useful and predictable timing.

In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 40 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by the client as a forward cache, By requesting more than one streamlet 212 at a time in a manner referred to as "parallel retrieval," or more than one part of a streamlet 212 at a time, 45 efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 212 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection 50 fail. Streamlet 212 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from falling into a slow-start or close mode. If the network controller module 406 has requested a streamlet 212 in multiple parts, with each part requested on mutually inde- 55 pendent TCP/IP connections, the network controller module 406 reassembles the parts to present a complete streamlet 212 for use by all other components of the client module 114.

When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet 60 212. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet 212, If the first, streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the 65 redundant request response, the first request may be aborted.

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Several streamlet 212 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This eliminates all but the first request latency. Because multiple responses are always being transmitted, the processing latency of each new streamlet 212 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious vulnerabilities. Transmission delays affect all of the responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

Multiple TCP connections may be opened between the client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while maintaining the independence of each streamlet 212 request. Several streamlet 212 requests may be sent concurrently, with each request being sent on a mutually distinct TCP connection. This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does not affect the transmission of other responses because each response occupies an independent TCP connection. Any transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding

A single streamlet 212 request may be issued for an entire streamlet 212, or multiple requests may be issued, each for a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by the client module 114 streamlet.

In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three streamlet 212 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses diminishes the net response time of the other three responses. The timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to maintain the proper balance of efficiency and response times.

The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof of the illustrated method. Additionally, the format and symbols employed are provided to explain the logical steps of the method and are understood not to limit the scope of the method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood not to limit the scope of the corresponding method. Indeed, some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a wading or monitoring period of unspecified duration between enumer-

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ated steps of the depicted method. Additionally, the order in which a particular method occurs may or may not strictly adhere to the order of the corresponding steps shown.

FIG. 5 is a schematic flowchart diagram illustrating one embodiment of a method 500 for processing content in accordance with the present invention. In one embodiment the method 500 starts 502, and the content module 112 receives 504 content from the publisher 110. Receiving content 504 may comprise receiving 504 a digital copy of the content file 200, or digitizing a physical copy of the content file 200. Alternatively, receiving 504 content may comprise capturing a radio or television broadcast. Once received 504, the stream module 302 generates 506 a plurality of streams 202, each stream 202 having a different quality. The quality may be predefined, or automatically set according to end user bandwidth, or in response to pre-designated publisher guidelines

The streamlet module 304 receives the streams 202 and generates 508 a plurality of streamlets 212. In one embodiment, generating 508 streamlets comprises dividing the 20 stream 202 into a plurality of two second streamlets 212. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202, The encoder module 306 then encodes 510 the streamlets according to a compression algorithm. In a further embodiment, the algorithm comprises 25 a proprietary codec such as WMV9®. The encoder module 306 then stores 512 the encoded streamlets in the streamlet database 308. Once stored 512, the web server 116 may then serve 514 the streamlets. In one embodiment, serving 514 the streamlets comprises receiving streamlet requests from the 30 client module 114, retrieving the requested streamlet from the streamlet database 308, and subsequently transmitting the streamlet to the client module 114. The method 500 then ends

FIG. 6 is a schematic flow chart diagram illustrating one 35 embodiment of a method 600 for viewing a plurality of streamlets in accordance with the present invention. The method 600 starts and an agent control module 402 is provided 604 and associated with a viewer 408 and provided with a staging module 409. The agent controller module 402 then 40 requests 606 a streamlet from the streamlet cache module 404. Alternatively, the agent controller module 402 may simultaneously request 606 a plurality of streamlets from the streamlet cache module 404. If the streamlet is stored 608 locally in the streamlet cache 410, the streamlet cache module 45 404 retrieves 610 the streamlet and sends the streamlet to the agent controller module 402. Upon retrieving 610 or receiving a streamlet, the agent controller module 402 makes 611 a determination of whether or not to shift, to a higher or lower quality stream 202. This determination will be described 50 below in greater detail with reference to FIG. 7.

In one embodiment, the staging module 409 then arranges 612 tire streamlets into the proper order, and the agent controller module 402 delivers 614 the streamlets to the viewer **408**. In a further embodiment, delivering **614** streamlets to the 55 end user comprises playing video and or audio streamlets on the viewer 408. If the streamlets are not stored 608 locally, the streamlet request is passed to the network controller module 406. The network controller module 406 then requests 616 the streamlet from the web server 116. Once the streamlet is received, the network controller module 406 passes the streamlet to the streamlet cache module 404. The streamlet cache module 404 archives 618 the streamlet. Alternatively, the streamlet cache module 404 then archives 618 the streamlet and passes the streamlet to the agent controller module 65 402, and the method 600 then continues from operation 610 as described above.

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Referring now to FIG. 7, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 700 for requesting streamlets within a adaptive-rate shifting content streaming environment in accordance with the present invention. The method 700 may be used in one embodiment as the operation 611 of FIG. 6. The method 700 starts and the agent controller module 402 receives 704 a streamlet as described above with reference to FIG. 6. The agent controller module 402 then monitors 706 the receive time of the requested streamlet. In one embodiment, the agent controller module 402 monitors the time intervals  $\Delta$  between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given  $\Delta$  may vary substantially from another. In order to compensate for this fluctuation, the agent controller module **402** calculates **708** a performance ratio r across a window of n samples for streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i},$$

Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ratio r, the agent control module 402 may calculate a geometric mean, or alternatively an equivalent averaging algorithm, across a window of size m, and obtain a performance factor  $\phi$ :

$$\varphi_{current} = \left(\prod_{j=1}^{m} r_j\right)^{\frac{1}{m}}.$$

The policy determination about whether or not to upshift 710 playback quality begins by comparing  $\varphi_{\mathit{current}}$  with a trigger threshold  $\Theta_{up}$ . If  $\phi_{current} \ge \Theta_{up}$ , then an up shift to the next, higher quality stream may be considered 716. In one embodiment, the trigger threshold  $\Theta_{up}$  is determined by a combination of factors relating to the current read ahead margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 409 for presentation at the current playback time index), and a minimum safety margin. In one embodiment, the minimum safety margin may be 24 seconds. The smaller the read ahead margin, the larger  $\Theta_{\textit{up}}$  is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 402 is able to sustain 716 upshift quality, then the agent controller module 402 will upshift 717 the quality and subsequently request higher qualify streams. The determination of whether use of the higher quality stream is sustainable 716 is made by comparing an estimate of the higher quality stream's performance factor,  $\phi_{higher}$ , with  $\Theta_{up}$ . If  $\phi_{higher} \ge \Theta_{up}$  then use of the higher quality stream is considered sustainable. If the decision of whether or not the higher stream rate is sustainable 716 is "no," the agent control module 402 will not attempt to upshift 717 stream quality. If the end of the stream has been reached 714, the method 618 ends 716.

If the decision on whether or not to attempt upshift 710 is "no", a decision about whether or not to downshift 712 is made. In one embodiment, a trigger threshold  $\Theta_{down}$  is

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defined in a manner analogous to  $\Theta_{up}$ . If  $\phi_{current} > \Theta_{down}$  then the stream quality may be adequate, and the agent controller module **402** does not downshift **718** stream quality. However, if  $\phi_{current} \le \Theta_{down}$ , the agent controller module **402** does downshift **718** the stream quality. If the end of the stream has not been reached **714**, the agent controller module **402** begins to request and receive **704** lower quality streamlets and the method **618** starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced by alternative streamlet monitoring solutions.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims 15 rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

- 1. An end user station for adaptive-rate content streaming 20 of digital content from a video server over a network, the end user station comprising:
  - a media player operating on the end user station configured to stream a video from the video server via at least one transmission control protocol (TCP) connection over the 25 network, wherein multiple different copies of the video encoded at different bit rates are stored on the video server as multiple sets of files, wherein each of the files yields a different portion of the video on playback, wherein the files across the different copies yield the 30 same portions of the video on playback, and wherein each of the files comprises a time index such that the files whose playback is the same portion of the video for each of the different copies have the same time index in relation to the beginning of the video, and wherein the media 35 player streams the video by:
  - requesting a plurality of sequential files of one of the copies from the video server based on the time indexes;
  - automatically requesting from the video server subsequent portions of the video by requesting for each such portion 40 one of the files from one of the copies dependent upon successive determinations by the media player to shift the playback quality to a higher or lower quality one of the different copies, the automatically requesting including repeatedly generating a factor indicative of the 45 current ability to sustain the streaming of the video using the files from different ones of the copies, wherein the set of one or more factors relate to the performance of the network;
  - making the successive determinations to shift the playback 50 quality based on the factor to achieve continuous playback of the video using the files of the highest quality one of the copies determined sustainable at that time so that the media player upshifts to a higher quality one of the different copies when the factor is greater than a first 55 threshold and downshifts to a lower quality one of the different copies when the factor is less than a second threshold; and
  - presenting the video by playing back the requested media files with the media player on the end user station in 60 order of ascending playback time.
- 2. The end user station of claim 1, wherein the at least one TCP connection comprises multiple Transmission Control protocol (TCP) connections with the content server.
- 3. The end user station of claim 1, wherein the media player 65 is configured to generate the factor according to the responses to segment requests.

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- **4**. The end user station of claim **1**, wherein the media player is configured to upshift to the higher quality copy when the factor is greater than the first threshold and the media player determines the higher quality playback can be sustained according to a combination of factors.
- 5. The end user station of claim 1 wherein the media player is configured to upshift to the higher quality copy when the performance factor is greater than the first threshold and the media player determines that the higher quality playback can be sustained according to an amount of contiguously available files stored by the media player.
- **6**. The end user station of claim **1**, wherein the media player is further configured to anticipate file requests and to prerequest files to enable fast-forward, skip randomly, and rewind functionality.
- 7. The end user station of claim 1, wherein the media player is configured to initially request low quality files to enable instant playback of the video, and to subsequently upshift to a better quality copy of the video according to the performance factor.
- **8**. A method executable by an end user station to present rate-adaptive streams received via at least one transmission control protocol (TCP) connection with a server over a network, the method comprising;
  - streaming, by a media player operating on the end user station, a video from the server via the at least one TCP connection over the network, wherein multiple different copies of the video encoded at different bit rates are stored as multiple sets of files on the server, wherein each of the files yields a different portion of the video on playback, wherein the files across the different copies yield the same portions of the video on playback, and wherein each of the files comprises a time index such that the files whose playback is the same portion of the video for each of the different copies have the same time index in relation to the beginning of the video, and wherein the streaming comprises:
  - requesting by the media player a plurality of sequential files of one of the copies from the server based on the time indexes;
  - automatically requesting by the media player from the server subsequent portions of the video by requesting for each such portion one of the files from one of the copies dependent upon successive determinations by the media player to shift the playback quality to a higher or lower quality one of the different copies, the automatically requesting including repeatedly generating a factor indicative of the current ability to sustain the streaming of the video using the files from different ones of the copies, wherein the factor relates to the performance of the network; and
  - making the successive determinations to shift the playback quality based on the factor to achieve continuous playback of the video using the files of the highest quality one of the copies determined sustainable at that time, wherein the making the successive determinations to shift comprises upshifting to a higher quality one of the different copies when the at least one factor is greater than a first threshold and downshifting to a lower quality one of the different copies when the at least one factor is less than a second threshold; and
  - presenting the video by playing back the requested media files with the media player on the end user station in order of ascending playback time.
- **9**. The method of claim **8**, wherein the at least one TCP connection comprises a plurality of different TCP connections, and wherein the requesting the plurality of sequential

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files includes requesting sub-parts of the files over different ones of the plurality of different TCP connections, and wherein said presenting includes reassembling the files from the received sub-parts.

**10**. The method of claim **8**, wherein said making the successive determinations to shift comprises:

determining if the higher quality playback can be sustained.

- 11. The method of claim 8, wherein the at least one TCP connection comprises a plurality of different TCP connections, and wherein the automatically requesting includes requesting sub-parts of the files over different ones of the plurality of TCP connections, and wherein said presenting includes reassembling the files from the received sub-parts, and wherein the factor is indicative of the available bandwidth of the plurality of TCP connections.
- 12. The method of claim 8, wherein the factor is indicative of latency of the requested files, wherein the latency is a time

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measure between when one of the requests is issued and a time that response data of the request begins to arrive at the end user station.

- 13. The method of claim 8, wherein the factor is indicative of time intervals between successive receive times for each response to the requested files.
- 14. The method of claim 8, wherein the factor is indicative of delays or losses in one or more of the at least one TCP connection.
- 15. The method of claim 8, wherein the server is a web server, and wherein the files are requested from the web server using Hyper Text Transfer Protocol (HTTP) messages sent via the at least one TCP connection.
- **16**. The method of claim **8**, wherein the server comprises a cache server of a network infrastructure operator.

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# GZJ KDKY'F



## (12) United States Patent

Brueck et al.

## (45) Date of Patent:

### \*Nov. 5, 2019

US 10,469,554 B2

#### (54) APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

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Englewood, CO (US)

Subject to any disclaimer, the term of this Notice:

patent is extended or adjusted under 35

U.S.C. 154(b) by 0 days.

This patent is subject to a terminal dis-

claimer.

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(65)**Prior Publication Data** 

> US 2019/0158560 A1 May 23, 2019

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- (51) Int. Cl. H04L 29/06 (2006.01)H04L 12/927 (2013.01)(Continued)
- (52) U.S. Cl. CPC ....... H04L 65/607 (2013.01); G06F 16/183 (2019.01); *G06F 16/71* (2019.01); (Continued)
- (58) Field of Classification Search CPC .. H04N 19/34; H04N 19/40; H04N 21/23427; H04N 21/2662;

(Continued)

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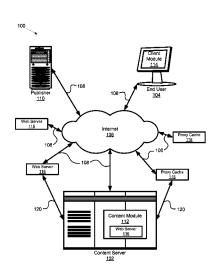
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Primary Examiner - Chirag R Patel (74) Attorney, Agent, or Firm — Lorenz & Kopf LLP

#### (57)ABSTRACT

An apparatus for multi-bitrate content streaming includes a receiving module configured to capture media content, a streamlet module configured to segment the media content and generate a plurality of streamlets, and an encoding module configured to generate a set of streamlets. The system includes the apparatus, wherein the set of streamlets comprises a plurality of streamlets having identical time indices and durations, and each streamlet of the set of streamlets having a unique bitrate, and wherein the encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. A method includes receiving media content, segmenting the media content and generating a plurality of streamlets, and generating a set of streamlets.

#### 30 Claims, 11 Drawing Sheets



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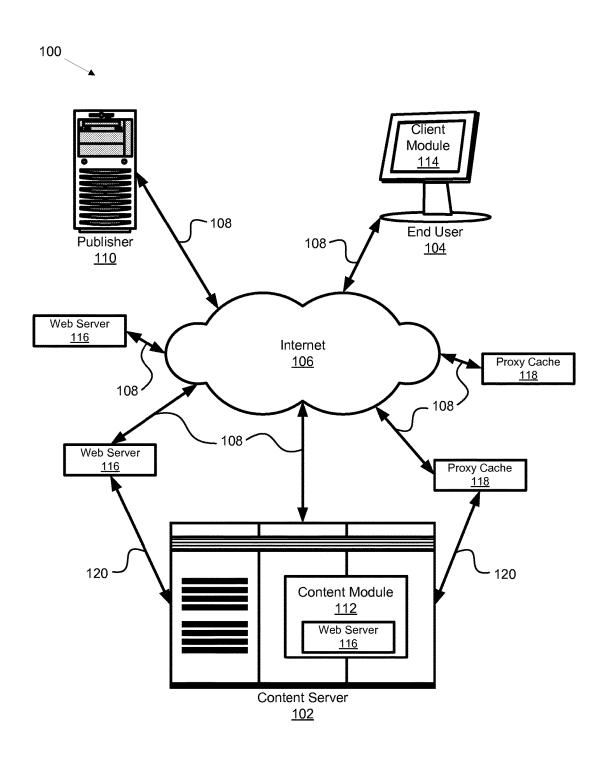


FIG. 1

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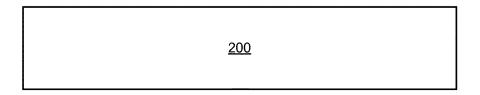


FIG. 2a

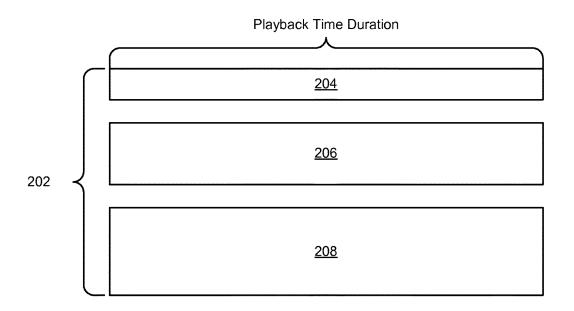
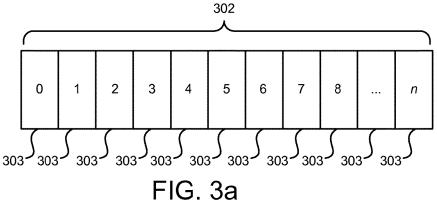


FIG. 2b

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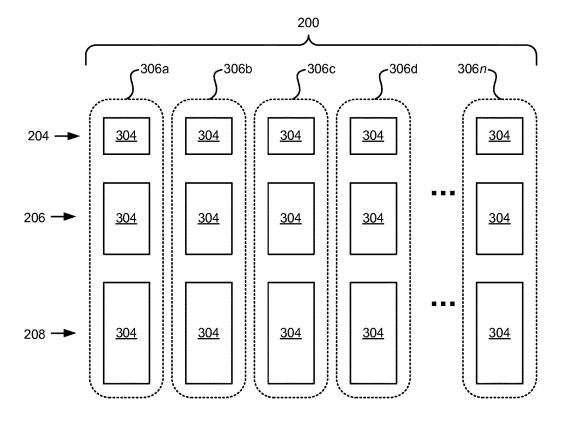
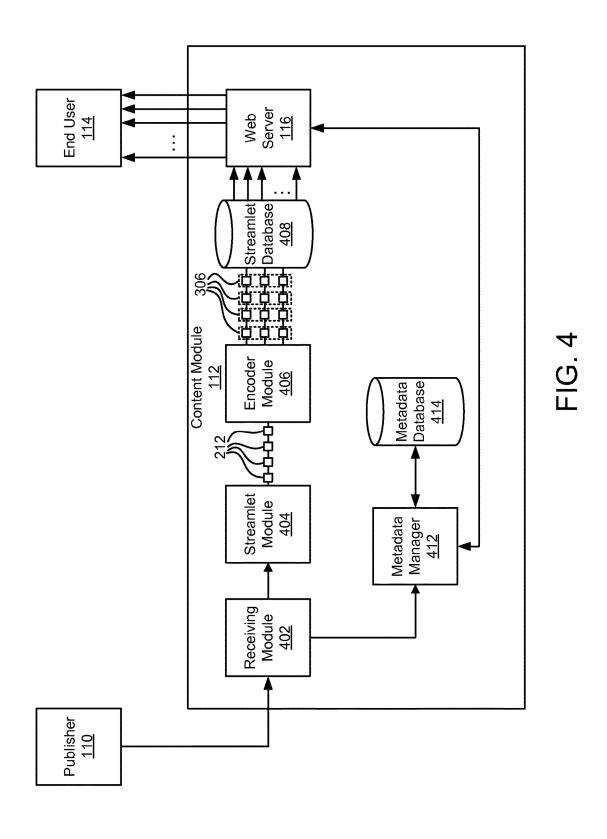


FIG. 3b

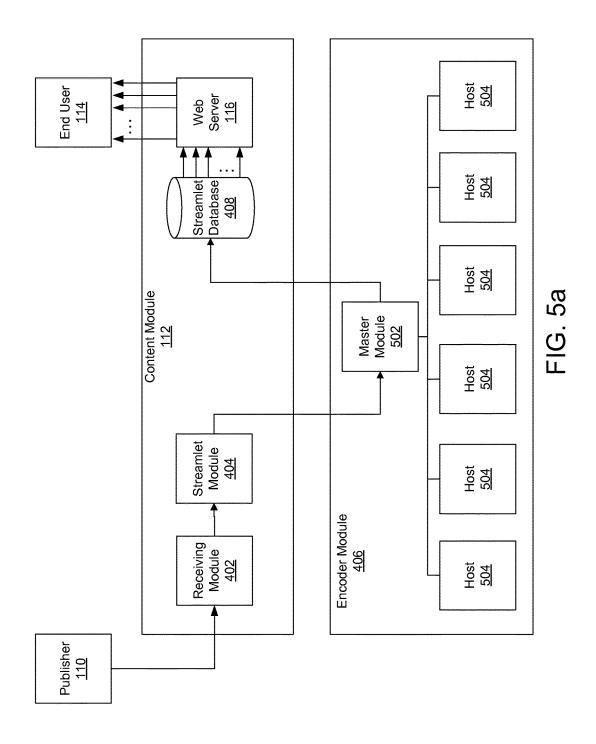
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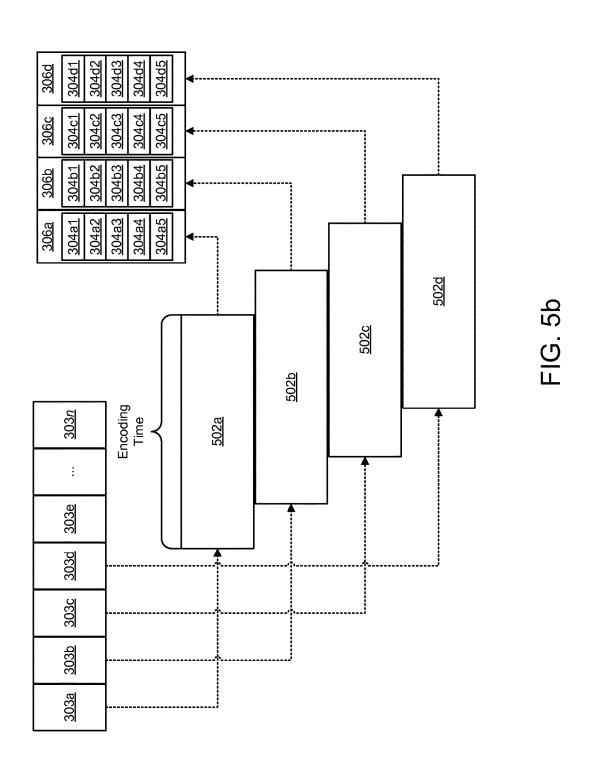
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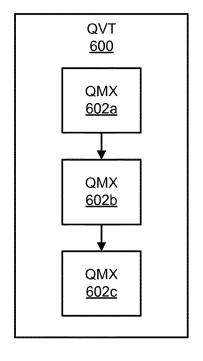
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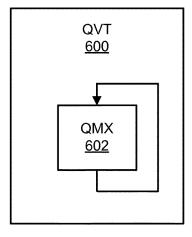


FIG. 6b

FIG. 6a

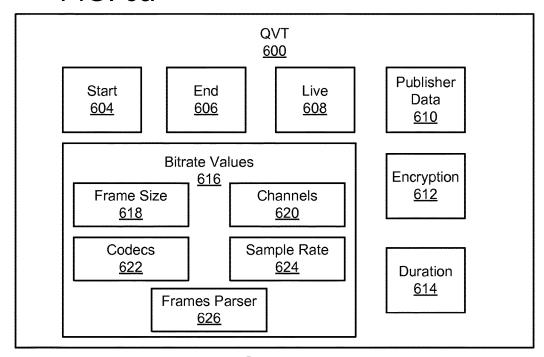
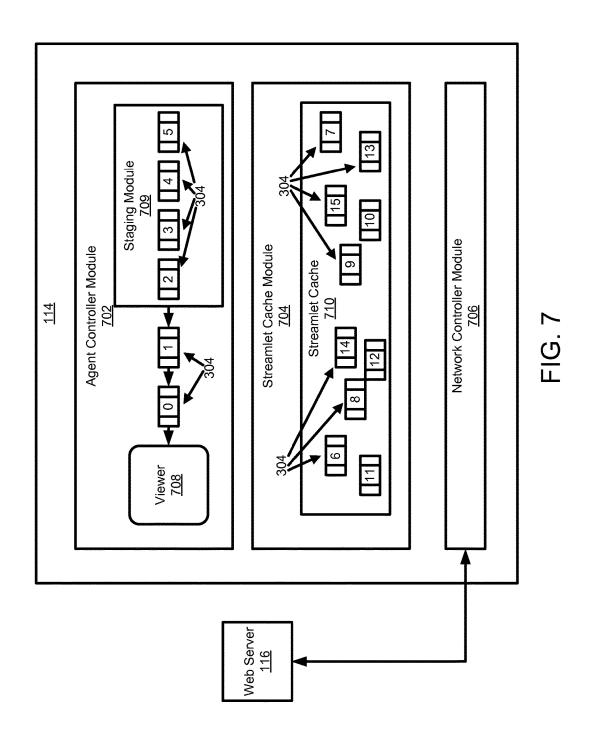


FIG. 6c

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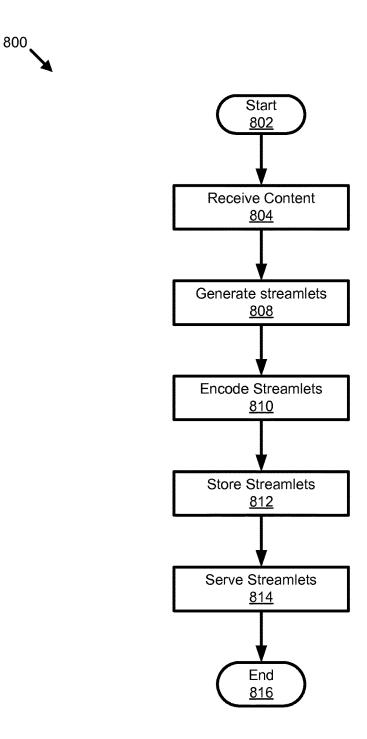


FIG. 8

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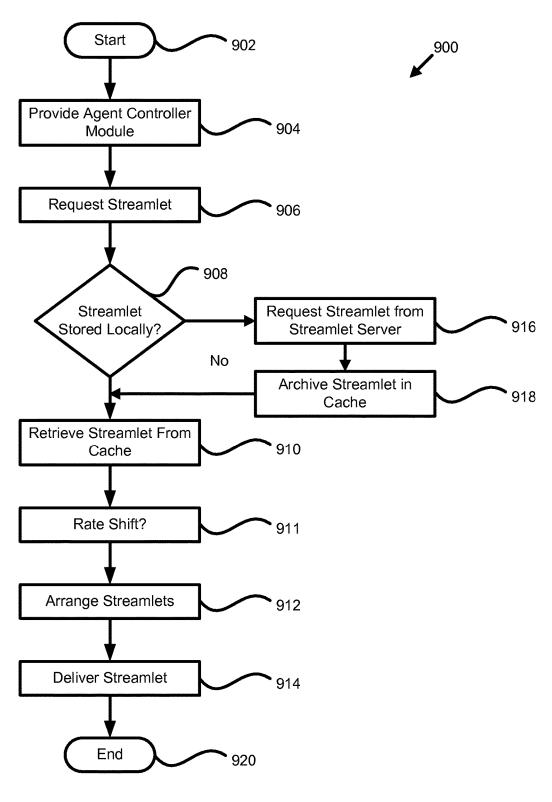
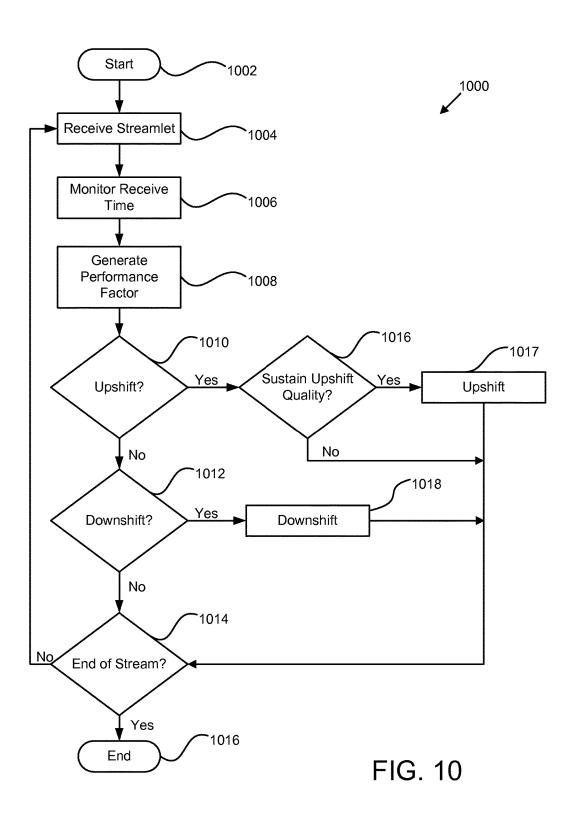


FIG. 9

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**Sheet 11 of 11** 



#### 1 APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

#### CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 16/004,056 filed on Jun. 8, 2018, which is a continuation of U.S. patent application Ser. No. 15/414,027 (now U.S. Pat. No. 9,998,516) filed on Jan. 24, 2017, which 10 is a continuation of U.S. patent application Ser. No. 14/719, 122 filed on May 21, 2015, which is a continuation of U.S. patent application Ser. No. 14/106,051 filed on Dec. 13, 2013 (now U.S. Pat. No. 9,071,668), which is a continuation of U.S. patent application Ser. No. 13/617,114, filed on Sep. 14, 2012 (now U.S. Pat. No. 8,612,624), which is a continuation of U.S. patent Ser. No. 12/906,940 filed on Oct. 18, 2010 (now U.S. Pat. No. 8,402,156), which is a continuation of U.S. patent application Ser. No. 11/673,483, filed on Feb. 9, 2007 (now U.S. Pat. No. 7,818,444), which is a continu- 20 ation-in-part of application Ser. No. 11/116,783, filed on Apr. 28, 2005 (now U.S. Pat. No. 8,868,772), which claims the benefit of U.S. Provisional Application No. 60/566,831, filed on Apr. 31, 2004, all of which are incorporated herein by reference.

#### BACKGROUND OF THE INVENTION

#### Field of the Invention

The invention relates to video streaming over packet switched networks such as the Internet, and more particularly relates to adaptive-rate shifting of streaming content over such networks.

#### Description of the Related Art

The Internet is fast becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or 40 practically any network capable device. Many portable media players are equipped with network connections and enabled to play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a 45 server.

"Streaming media" refers to technology that delivers content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently 50 deleted. The user has the immediate satisfaction of viewing the requested content without waiting for the media file to completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network 55 connection. Streaming may be used to deliver content on demand (previously recorded) or from live broadcasts.

Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media 60 files can take large amounts of time depending on the network connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a higher quality audio/video than can be delivered in real time. 65 Users generally dislike this option, as they tend to want to see or hear the media file instantaneously.

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Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for viewing on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also vulnerable to network failures or congestion.

Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for 35 a moment and then slowly resumes the original transmission pace. This behavior is an attempt to alleviate the perceived congestion. Such a slowdown is detrimental to the viewing or listening experience of the user and therefore is not acceptable.

The second challenge to data transport is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

The third challenge is latency. Latency is the time measure form the client's point-of-view, of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput

From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

#### SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems. Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the abovediscussed shortcomings in the art.

The apparatus for adaptive-rate content streaming is provided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include a 15 receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, and an encoding module configured to encode each streamlet as a separate content file.

The encoding module is further configured to generate a set of streamlets for each of the sequential streamlets. Each streamlet may comprise a portion of the media content having a predetermined length of time. The predetermined length of time may be in the range of between about 0.1 and 25 5 seconds.

In one embodiment, a set of streamlets comprises a plurality of streamlets having identical time indices, and each streamlet of the set of streamlets has a unique bitrate. The receiving module is configured to convert the media 30 content to raw audio or raw video. The encoding module may include a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. The job completion bid may be based on a plurality of computing 35 variables selected from a group consisting of current encoding job completion percentage, average encoding job completion time, processor speed, and physical memory

A system of the present invention is also presented for 40 adaptive-rate content streaming. In particular, the system, in one embodiment, includes a receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, each streamlet comprising a portion of 45 the media content having a predetermined length of time, and an encoding module configured to encode each streamlet as a separate content file and generate a set of streamlets.

The system also includes a plurality of streamlets having identical time indices and each streamlet of the set of 50 ing content in accordance with the present invention; streamlets having a unique bitrate. The encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid.

A method of the present invention is also presented for 55 adaptive-rate content streaming. In one embodiment, the method includes receiving media content, segmenting the media content and generating a plurality of sequential streamlets, and encoding each streamlet as a separate content

The method also includes segmenting the media content into a plurality of streamlets, each streamlet comprising a portion of the media content having a predetermined length of time. In one embodiment, the method includes generating a set of streamlets comprising a plurality of streamlets 65 having identical time indices, and each streamlet of the set of streamlets having a unique bitrate.

Furthermore, the method may include converting the media content to raw audio or raw video, and segmenting the content media into a plurality of sequential streamlets. The method further comprises assigning an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid, and submitting an encoding job completion bid based on a plurality of computing

Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specifi-20 cation may, but do not necessarily, refer to the same embodi-

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention.

These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

#### BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

FIG. 1 is a schematic block diagram illustrating one embodiment of a system for dynamic rate shifting of stream-

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content file;

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth;

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of source streamlets;

FIG. 3b is a schematic block diagram illustrating one 60 embodiment of sets of streamlets in accordance with the present invention;

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module in accordance with the present invention;

FIG. 5a is a schematic block diagram illustrating one embodiment of an encoder module in accordance with the present invention;

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FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention:

FIG. **6***a* is a schematic block diagram illustrating one embodiment of a virtual timeline in accordance with the <sup>5</sup> present invention;

FIG. **6***b* is a schematic block diagram illustrating an alternative embodiment of a VT in accordance with the present invention:

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX in accordance with the present invention:

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with  $_{15}$  the present invention:

FIG. **8** is a schematic flow chart diagram illustrating one embodiment of a method for processing content in accordance with the present invention;

FIG.  $\bf 9$  is a schematic flow chart diagram illustrating one  $_{20}$  embodiment of a method for viewing a plurality of streamlets in accordance with the present invention; and

FIG. 10 is a schematic flow chart diagram illustrating one embodiment of a method for requesting streamlets within an adaptive-rate shifting content streaming environment in <sup>25</sup> accordance with the present invention.

## DETAILED DESCRIPTION OF THE INVENTION

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, 35 off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or 45 function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein 55 within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely 60 as electronic signals on a system or network.

Reference throughout this specification to "one embodiment," "an embodiment." or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one 65 embodiment of the present invention. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and

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similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

Reference to a signal bearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machine-readable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device. In one embodiment, a computer program product including a computer useable medium having a computer readable program of computer instructions stored thereon that when executed on a computer causes the computer to carry out operations for multi-bitrate content streaming as described herein.

Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention

FIG. 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user station 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured to present content. For example, portable electronic devices may include, but are not limited to, cellular phones, portable gaming systems, and portable computing devices.

In the depicted embodiment, the system 100 also includes a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For example, if the content to be streamed were a broadcast of a television program, the publisher 110 may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the Internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may be configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of locations simultaneously. For example, the client module 114 may request and receive content from any of the plurality of web servers 116.

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Content from the content server 102 may be replicated to other web servers 116 or alternatively to proxy cache servers 118. Replicating may occur by deliberate forwarding from the content server 102, or by a web, cache, or proxy server outside of the content server 102 asking for content on behalf of the client module 114. In a further embodiment, content may be forwarded directly to web 116 or proxy 118 servers through direct communication channels 120 without the need to traverse the Internet 106.

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content (hereinafter "content") file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Alternatively, the content file 200 may be compressed using standard or proprietary encoding schemes. Examples of encoding schemes capable of use with the present invention include, but are not limited to, DivX®, Windows Media Video®, Quicktime Sorenson 3®, On2, OGG Vorbis. MP3, or Quicktime 6.5/MPEG-4® encoded content.

FIG. 2b is a schematic block diagram illustrating one 25 embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the plurality of streams 202 comprises a low quality stream 204, a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content 30 file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and compressed to a bit rate of 100 kilobits per second (kbps), the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 35 208 may be encoded and compressed to 600 kbps.

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream 302 divided into a plurality of source streamlets 303. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 303 40 may comprise a portion of the content contained in stream 302, encapsulated as an independent media object. The content in a streamlet 303 may have a unique time index in relation to the beginning of the content contained in stream 302. In one embodiment, the content contained in each 45 streamlet 303 may have a duration of two seconds. For example, streamlet 0 may have a time index of 00:00 representing the beginning of content playback, and streamlet 1 may have a time index of 00:02, and so on. Alternatively, the time duration of the streamlets 304 may be any 50 duration smaller than the entire playback duration of the content in stream 302. In a further embodiment, the streamlets 303 may be divided according to file size instead of a time index and duration.

FIG. 3b is a schematic block diagram illustrating one 55 embodiment of sets 306 of streamlets in accordance with the present invention. As used herein, the term "set" refers to a group of streamlets having identical time indices and durations but varying bitrates. In the depicted embodiment, the set 306a encompasses all streamlets having a time index of 60 00:00. The set 306a includes encoded streamlets 304 having low, medium, and high 204, 206, 208 bitrates. Of course each set 306 may include more than the depicted three bitrates which are given by way of example only. One skilled in the art will recognize that any number of streams 65 having different bitrates may be generated from the original content 200.

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As described above, the duration of one streamlet 304 may be approximately two seconds. Likewise each set 306 may comprise a plurality of streamlets 304 where each streamlet 304 has a playable duration of two seconds. Alternatively, the duration of the streamlet 304 may be predetermined or dynamically variable depending upon a variety of factors including, but not limited to, network congestion, system specifications, playback resolution and quality, etc. In the depicted embodiment, the content 200 may be formed of the plurality of sets 306. The number of sets 306 may depend on the length of the content 200 and the length or duration of each streamlet 304.

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 112 may comprise a capture module 402, a streamlet module 404, an encoder module 406, a streamlet database 408, and the web server 116. In one embodiment, the capture module 402 is configured to receive the content file 200 from the publisher 110. The capture module 402 may be configured to "decompress" the content file 200. For example, if the content file 200 arrives having been encoded with one of the above described encoding schemes, the capture module 402 may convert the content file 200 into raw audio and/or video. Alternatively, the content file 200 may be transmitted by the publisher in a format 110 that does not require decompression.

The capture module **402** may comprise a capture card configured for TV and/or video capture. One example of a capture card suitable for use in the present invention is the DRC-2500 by Digital Rapids of Ontario, Canada. Alternatively, any capture card capable of capturing audio and video may be utilized with the present invention. In a further embodiment, the capture module **402** is configured to pass the content file to the streamlet module **404**.

The streamlet module 404, in one embodiment, is configured to segment the content file 200 and generate source streamlets 303 that are not encoded. As used herein, the term "segment" refers to an operation to generate a streamlet of the content file 200 having a duration or size equal to or less than the duration or size of the content file 200. The streamlet module 404 may be configured to segment the content file 200 into streamlets 303 each having an equal duration. Alternatively, the streamlet module 404 may be configured to segment the content file 200 into streamlets 303 having equal file sizes.

The encoding module 406 is configured to receive the source streamlets 303 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in the art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

In a further embodiment, the encoding module 406 is configured to generate a plurality of sets 306 of streamlets 304. The sets 306, as described above with reference to FIG. 3b, may comprise streamlets having an identical time index and duration, and a unique bitrate. As with FIG. 3b, the sets 306 and subsequently the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively, the plurality of streams 202 may comprise any number of streams deemed necessary to accommodate end user bandwidth.

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The encoder module 406 is further configured to encode each source streamlet 303 into the plurality of streams 202 and streamlet sets 306 and store the streamlets in the streamlet database 408. The encoding module 406 may utilize encoding schemes such as DivX®, Windows Media 5 Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/MPEG-4®. Alternatively, a custom encoding scheme may be employed.

The content module 112 may also include a metadata module 412 and a metadata database 414. In one embodi- 10 ment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be configured to define an end user environment. In 15 one embodiment, the publisher 100 may define an end user navigational environment for the content including menus, thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, pause, and play that may be used with the content file 200. 20 The metadata module 412 is configured to receive the metadata from the publisher 110 and store the metadata in the metadata database 414. In a further embodiment, the metadata module 412 is configured to interface with the client module 114, allowing the client module 114 to search 25 for content based upon at least one of a plurality of metadata criteria. Additionally, metadata may be generated by the content module 112 through automated process(es) or manual definition.

Once the streamlets **304** have been received and processed, the client module **114** may request streamlets **304** using HTTP from the web server **116**. Using a standard protocol such as HTTP eliminates the need for network administrators to configure firewalls to recognize and pass through network traffic for a new, specialized protocol. 35 Additionally, since the client module **114** initiates the request, the web server **116** is only required to retrieve and serve the requested streamlet **304**. In a further embodiment, the client module **114** may be configured to retrieve streamlets **304** from a plurality of web servers **116**.

Each web server 116 may be located in various locations across the Internet 106. The streamlets 304 may essentially be static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 304. Streamlets 304 may be served by the 45 web server 116 or cached by cache servers of Internet Service Providers (ISPs), or any other network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution 50 is provided that is not hindered by massive amounts of client module 114 requests to the web server 116 at any specific location, especially the web server 116 most closely associated with or within the content module 112

FIG. 5a is a schematic block diagram illustrating one 55 embodiment of an encoder module 406 in accordance with the present invention. In one embodiment, the encoder module 406 may include a master module 502 and a plurality of host computing modules (hereinafter "host") 504. The hosts 504 may comprise personal computers, 60 servers, etc. In a further embodiment, the hosts 504 may be dedicated hardware, for example, cards plugged into a single computer.

The master module (hereinafter "master") 502 is configured to receive streamlets 303 from the streamlet module 65 404 and stage the streamlet 303 for processing. In one embodiment, the master 502 may decompress each source

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streamlet 303 to produce a raw streamlet. As used herein, the term "raw streamlet" refers to a streamlet 303 that is uncompressed or lightly compressed to substantially reduce size with no significant loss in quality. A lightly compressed raw streamlet can be transmitted more quickly and to more hosts. Each host 504 is coupled with the master 502 and configured to receive a raw streamlet from the master 502 for encoding. The hosts 504, in one example, generate a plurality of streamlets 304 having identical time indices and durations, and varying bitrates. Essentially each host 504 may be configured to generate a set 306 from the raw streamlet 503 sent from the master 502. Alternatively, each host 504 may be dedicated to producing a single bitrate in order to reduce the time required for encoding.

Upon encoding completion, the host 504 returns the set 306 to the master 502 so that the encoding module 406 may store the set 306 in the streamlet database 408. The master 502 is further configured to assign encoding jobs to the hosts 504. Each host is configured to submit an encoding job completion bid (hereinafter "bid"). The master 502 assigns encoding jobs depending on the bids from the hosts 504. Each host 504 generates a bid depending upon a plurality of computing variables which may include, but are not limited to, current encoding job completion percentage, average job completion time, processor speed and physical memory capacity.

For example, a host 504 may submit a bid that indicates that based on past performance history the host 504 would be able to complete the encoding job in 15 seconds. The master 502 is configured to select from among a plurality of bids the best bid and subsequently submit the encoding job to the host 504 with the best bid. As such, the described encoding system does not require that each host 504 have identical hardware but beneficially takes advantage of the available computing power of the hosts 504. Alternatively, the master 502 selects the host 504 based on a first come first serve basis, or some other algorithm deemed suitable for a particular encoding job.

The time required to encode one streamlet 304 is dependent upon the computing power of the host 504, and the encoding requirements of the content file 200. Examples of encoding requirements may include, but are not limited to, two or multi-pass encoding, and multiple streams of different bitrates. One benefit of the present invention is the ability to perform two-pass encoding on a live content file 200. Typically, in order to perform two-pass encoding prior art systems must wait for the content file to be completed before encoding.

The present invention, however, segments the content file 200 into source streamlets 303 and the two-pass encoding to a plurality of streams 202 may be performed on each corresponding raw streamlet without waiting for a TV show to end, for example. As such, the content module 112 is capable of streaming the streamlets over the Internet shortly after the content module 112 begins capture of the content file 200. The delay between a live broadcast transmitted from the publisher 110 and the availability of the content depends on the computing power of the hosts 504.

FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention. In one example, the capture module 402 (of FIG. 4) begins to capture the content file and the streamlet module 404 generates a first streamlet 303a and passes the streamlet to the encoding module 406. The encoding module 406 may take 10 seconds, for example, to generate the first set 306a of streamlets 304a (304a1, 304a2, 304a3, etc. represent streamlets 304 of

different bitrates). FIG. 5b illustrates the encoding process generically as block 502 to graphically illustrate the time

duration required to process a raw or lightly encoded streamlet 303 as described above with reference to the encoding module 406. The encoding module 406 may simultaneously process more than one streamlet 303, and processing of streamlets will begin upon arrival of the streamlet from the capture module 402.

During the 10 seconds required to encode the first streamlet 303a, the streamlet module 404 has generated five additional 2-second streamlets 303b, 303c, 303d, 303e, 303f, for encoding and the master 502 has prepared and staged the corresponding raw streamlets. Two seconds after the first set 306a is available the next set 306b is available, and so on. As such, the content file 200 is encoded for streaming over the Internet and appears live. The 10 second delay is given herein by way of example only. Multiple hosts 504 may be added to the encoding module 406 in order to increase the processing capacity of the encoding module 406. The delay may be shortened to an almost unperceivable level by the addition of high CPU powered systems, or alternatively multiple low powered systems.

A system as described above beneficially enables multipass encoding of live events. Multi-pass encoding systems 25 of the prior art require that the entire content be captured (or be complete) because in order to perform multi-pass encoding the entire content must be scanned and processed more than once. This is impossible with prior art systems because content from a live event is not complete until the event is 30 over. As such, with prior art systems, multi-pass encoding can only be performed once the event is over. Streamlets, however, may be encoded as many times as is deemed necessary. Because the streamlet is an encapsulated media object of 2 seconds (for example), multi-pass encoding may 35 begin on a live event once the first streamlet is captured. Shortly after multi-pass encoding of the first streamlet 303a is finished, multi-pass encoding of the second streamlet 303b finishes, and as such multi-pass encoding is performed on a live event and appears live to a viewer.

Any specific encoding scheme applied to a streamlet may take longer to complete than the time duration of the streamlet itself, for example, a very high quality encoding of a 2-second streamlet may take 5 seconds to finish. Alternatively, the processing time required for each streamlet may 45 be less than the time duration of a streamlet. However, because the offset parallel encoding of successive streamlets are encoded by the encoding module at regular intervals (matching the intervals at which the those streamlets are submitted to the encoding module 406, for example 2 50 seconds) the output timing of the encoding module 406 does not fall behind the real-time submission rate of the unencoded streamlets. Conversely, prior art encoding systems rely on the very fastest computing hardware and software because the systems must generate the output immediately 55 in lock-step with the input. A prior art system that takes 2.1 seconds to encode 2 seconds worth of content is considered a failure. The present invention allows for slower than real-time encoding processes yet still achieves a real-time encoding effect due to the parallel offset pipes.

The parallel offset pipeline approach described with reference to FIG. 5b beneficially allows for long or short encoding times without "falling behind" the live event. Additionally, arbitrarily complex encoding of streamlets to multiple profiles and optimizations only lengthens the 65 encoding time 502 without a perceptible difference to a user because the sets 306 of streamlets 304 are encoded in a

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time-selective manner so that streamlets are processed at regular time intervals and transmitted at these time intervals.

Returning now to FIG. 5a, as depicted, the master 502 and the hosts 504 may be located within a single local area network, or in other terms, the hosts 504 may be in close physical proximity to the master 502. Alternatively, the hosts 504 may receive encoding jobs from the master 502 over the Internet or other communications network. For example, consider a live sports event in a remote location where it would be difficult to setup multiple hosts. In this example, a master performs no encoding or alternatively light encoding before publishing the streamlets online. The hosts 504 would then retrieve those streamlets and encode the streamlets into the multiple bitrate sets 306 as described above.

Furthermore, hosts **504** may be dynamically added or removed from the encoding module without restarting the encoding job and/or interrupting the publishing of streamlets. If a host **504** experiences a crash or some failure, its encoding work is simply reassigned to another host.

The encoding module 406, in one embodiment, may also be configured to produce streamlets that are specific to a particular playback platform. For example, for a single raw streamlet, a single host 504 may produce streamlets for different quality levels for personal computer playback, streamlets for playback on cell phones with a different, proprietary codec, a small video-only streamlet for use when playing just a thumbnail view of the stream (like in a programming guide), and a very high quality streamlet for use in archiving.

FIG. 6a is a schematic block diagram illustrating one embodiment of a virtual timeline 600 in accordance with the present invention. In one embodiment, the virtual timeline 600 comprises at least one quantum media extension 602. The quantum media extension (hereinafter "QMX") 602 describes an entire content file 200. Therefore, the virtual timeline (hereinafter "VT") 600 may comprise a file that is configured to define a playlist for a user to view. For example, the VT may indicate that the publisher desires a user to watch a first show QMX 602a followed by QMX 602b and QMX 602c. As such, the publisher may define a broadcast schedule in a manner similar to a television station.

FIG. 6b is a schematic block diagram illustrating an alternative embodiment of a VT 600 in accordance with the present invention. In the depicted embodiment, the VT 600 may include a single QMX 602 which indicates that the publisher desires the same content to be looped over and over again. For example, the publisher may wish to broadcast a never-ending infomercial on a website.

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX 602 in accordance with the present invention. In one embodiment, the QMX 602 contains a multitude of information generated by the content module 112 configured to describe the content file 200. Examples of information include, but are not limited to, start index 604, end index 606, whether the content is live 608, proprietary publisher data 610, encryption level 612, content duration 614 and bitrate values 616. The bitrate values 616 may include frame size 618, audio channel 620 information, codecs 622 used, sample rate 624, and frames parser 626.

A publisher may utilize the QVT 600 together with the QMX 602 in order to prescribe a playback order for users, or alternatively selectively edit content. For example, a publisher may indicate in the QMX 602 that audio should be muted at time index 10:42 or video should be skipped for 3 seconds at time index 18:35. As such, the publisher may

selectively skip offensive content without the processing requirements of editing the content.

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module 114 in accordance with the present invention. The client module 114 may 5 comprise an agent controller module 702, a streamlet cache module 704, and a network controller module 706. In one embodiment, the agent controller module 702 is configured to interface with a viewer 708, and transmit streamlets 304 to the viewer 708. Alternatively, the agent controller module 10 702 may be configured to simply reassemble streamlets into a single file for transfer to an external device such as a portable video player.

In a further embodiment, the client module **114** may comprise a plurality of agent controller modules **702**. Each 15 agent controller module **702** may be configured to interface with one viewer **708**. Alternatively, the agent controller module **702** may be configured to interface with a plurality of viewers **708**. The viewer **708** may be a media player (not shown) operating on a PC or handheld electronic device.

The agent controller module **702** is configured to select a quality level of streamlets to transmit to the viewer **708**. The agent controller module **702** requests lower or higher quality streams based upon continuous observation of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to FIG. **10**.

The agent controller module 702 may be configured to receive user commands from the viewer 708. Such commands may include play, fast forward, rewind, pause, and stop. In one embodiment, the agent controller module 702 requests streamlets 304 from the streamlet cache module 704 and arranges the received streamlets 304 in a staging module 709. The staging module 709 may be configured to arrange the streamlets 304 in order of ascending playback time. In the depicted embodiment, the streamlets 304 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 304 may be identified with a unique filename.

Additionally, the agent controller module 702 may be 40 configured to anticipate streamlet 304 requests and prerequest streamlets 304. By pre-requesting streamlets 304, the user may fast-forward, skip randomly, or rewind through the content and experience no buffering delay. In a further embodiment, the agent controller module 702 may request 45 the streamlets 304 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 702 may request streamlets at any interval less than the length of the time index. This enables a "fast-start" capability with no buffer- 50 ing wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 702 may be configured to pre-request streamlets 304 corresponding to specified index points within the content or within other content in anticipation of the end user 104 55 selecting new content to view. In one embodiment, the streamlet cache module 704 is configured to receive streamlet 304 requests from the agent controller module 702. Upon receiving a request, the streamlet cache module 704 first checks a streamlet cache 710 to verify if the streamlet 304 60 is present. In a further embodiment, the streamlet cache module 704 handles streamlet 304 requests from a plurality of agent controller modules 702. Alternatively, a streamlet cache module 704 may be provided for each agent controller module 702. If the requested streamlet 304 is not present in 65 the streamlet cache 410, the request is passed to the network controller module 706. In order to enable fast forward and

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rewind capabilities, the streamlet cache module 704 is configured to store the plurality of streamlets 304 in the streamlet cache 710 for a specified time period after the streamlet 304 has been viewed. However, once the streamlets 304 have been deleted, they may be requested again from the web server 116.

The network controller module 706 may be configured to receive streamlet requests from the streamlet cache module 704 and open a connection to the web server 116 or other remote streamlet 304 database (not shown). In one embodiment, the network controller module 706 opens a TCP/IP connection to the web server 116 and generates a standard HTTP GET request for the requested streamlet 304. Upon receiving the requested streamlet 304, the network controller module 706 passes the streamlet 304 to the streamlet cache module 704 where it is stored in the streamlet cache 710. In a further embodiment, the network controller module 706 is configured to process and request a plurality of streamlets 304 simultaneously. The network controller module 706 20 may also be configured to request a plurality of streamlets, where each streamlet 304 is subsequently requested in multiple parts.

In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 304 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates problems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 304. Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more useful and predictable timing.

In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by the client as a forward cache. By requesting more than one streamlet 304 at a time in a manner referred to as "parallel retrieval," or more than one part of a streamlet 304 at a time, efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 304 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection fail. Streamlet 304 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from falling into a slow-start or close mode. If the network controller module 706 has requested a streamlet 304 in multiple parts, with each part requested on mutually independent TCP/IP connections, the network controller module 706 reassembles the parts to present a complete streamlet 304 for use by all other components of the client module 114.

When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet **304**. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet **304**. If the first streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the redundant request response, the first request may be aborted.

Several streamlet 304 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This eliminates all but the first request latency. Because multiple responses are always being transmitted, the processing

latency of each new streamlet 304 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious 5 vulnerabilities. Transmission delays affect all of the

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responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

Multiple TCP connections may be opened between the client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while maintaining the independence of each streamlet 304 request. Several streamlet 304 requests may be sent concurrently, 15 with each request being sent on a mutually distinct TCP connection. This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 20 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does not affect the transmission of other responses because each response occupies an independent TCP connection. Any 25 transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding responses.

A single streamlet 304 request may be issued for an entire streamlet 304, or multiple requests may be issued, each for 30 a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by the client module 114 streamlet.

In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new 35 streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three streamlet 304 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses diminishes the net response time of the other three responses. The 45 timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to maintain the proper balance of efficiency and response times.

The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the 50 depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof, of the illustrated method. Additionally, the format and symbols 55 employed are provided to explain the logical steps of the method and are understood not to limit the scope of the method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood not to limit the scope of the corresponding method. Indeed, 60 some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumerated steps of the depicted method. Additionally, the order in which a particular method occurs 65 may or may not strictly adhere to the order of the corresponding steps shown.

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FIG. 8 is a schematic flow chart diagram illustrating one embodiment of a method 800 for processing content in accordance with the present invention. In one embodiment the method 800 starts 802, and the content module 112 receives 804 content from the publisher 110. Receiving content 804 may comprise receiving 804 a digital copy of the content file 200, or digitizing a physical copy of the content file 200. Alternatively, receiving 804 content may comprise capturing a radio, television, cable, or satellite broadcast. Once received 804, the streamlet module 404 generates 808 a plurality of source streamlets 303 each having a fixed duration. Alternatively, the streamlets 303 may be generated with a fixed file size.

In one embodiment, generating 808 streamlets comprises dividing the content file 200 into a plurality of two second streamlets 303. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202. The encoder module 406 then encodes 810 the streamlets 303 into sets 306 of streamlets 304, in a plurality of streams 202 according to an encoding scheme. The quality may be predefined, or automatically set according to end user bandwidth, or in response to pre-designated publisher guidelines

In a further embodiment, the encoding scheme comprises a proprietary codec such as WMV9®. The encoder module 406 then stores 812 the encoded streamlets 304 in the streamlet database 408. Once stored 812, the web server 116 may then serve 814 the streamlets 304. In one embodiment, serving 814 the streamlets 304 comprises receiving streamlet requests from the client module 114, retrieving the requested streamlet 304 from the streamlet database 408, and subsequently transmitting the streamlet 304 to the client module 114. The method 800 then ends 816.

FIG. 9 is a schematic flow chart diagram illustrating one embodiment of a method 900 for viewing a plurality of streamlets in accordance with the present invention. The method 900 starts and an agent controller module 702 is provided 904 and associated with a viewer 708 and provided with a staging module 709. The agent controller module 702 then requests 906 a streamlet 304 from the streamlet cache module 704. Alternatively, the agent controller module 702 may simultaneously request 906 a plurality of streamlets 304 the streamlet cache module 704. If the streamlet is stored 908 locally in the streamlet cache 710, the streamlet cache module 704 retrieves 910 the streamlet 304 and sends the streamlet to the agent controller module 702. Upon retrieving 910 or receiving a streamlet, the agent controller module 702 makes 911 a determination of whether or not to shift to a higher or lower quality stream 202. This determination will be described below in greater detail with reference to FIG. 10.

In one embodiment, the staging module 709 then arranges 912 the streamlets 304 into the proper order, and the agent controller module 702 delivers 914 the streamlets to the viewer 708. In a further embodiment, delivering 914 streamlets 304 to the end user comprises playing video and or audio streamlets on the viewer 708. If the streamlets 304 are not stored 908 locally, the streamlet request is passed to the network controller module 706. The network controller module 706 then requests 916 the streamlet 304 from the web server 116. Once the streamlet 304 is received, the network controller module 706 passes the streamlet to the streamlet cache module 704. The streamlet cache module 704 archives 918 the streamlet. Alternatively, the streamlet cache module 704 then archives 918 the streamlet and passes the streamlet to the agent controller module 702, and the method 900 then continues from operation 910 as described above.

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Referring now to FIG. 10, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 1000 for requesting streamlets 304 within an adaptive-rate shifting content streaming environment in accordance with the present invention. The method 1000 may be used in one embodiment as the operation 911 of FIG. 9. The method 1000 starts and the agent controller module 702 receives 1004 a streamlet 304 as described above with reference to FIG. 9. The agent controller module 702 then monitors 1006 the receive time of the requested streamlet. In one embodiment, the agent controller module 702 monitors the time intervals A between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given A may vary substantially from another. In order to compensate for this fluctuation, the agent controller module **702** calculates **1008** a performance ratio r across a window of n samples for 20 streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation:

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}$$

Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ratio r, the agent controller module **702** may calculate a geometric mean, or alternatively an equivalent averaging algorithm, across a window of size m, and obtain a performance factor  $\phi$ :

$$\varphi_{current} = \left(\prod_{j=1}^{m} r_j\right)^{\frac{1}{m}}$$

The policy determination about whether or not to upshift 1010 playback quality begins by comparing  $\phi_{\it current}$  with a trigger threshold  $\Theta_{up}$ . If  $\phi_{current} \ge \Theta_{up}$ , then an up shift to the next higher quality stream may be considered 1016. In one 45 embodiment, the trigger threshold  $\Theta_{up}$  is determined by a combination of factors relating to the current read ahead margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 709 for presentation at the current playback time index), and 50 a minimum safety margin. In one embodiment, the minimum safety margin may be 24 seconds. The smaller the read ahead margin, the larger  $\Theta_{up}$  is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 702 is 55 able to sustain 1016 upshift quality, then the agent controller module 702 will upshift 1017 the quality and subsequently request higher quality streams. The determination of whether use of the higher quality stream is sustainable 1016 is made by comparing an estimate of the higher quality 60 stream's performance factor,  $\varphi_{higher}$ , with  $\Theta_{up}$ . If  $\varphi_{higher} \ge \Theta_{up}$  then use of the higher quality stream is considered sustainable. If the decision of whether or not the higher stream rate is sustainable 1016 is "no," the agent controller module 702 will not attempt to upshift 1017 stream quality. 65 If the end of the stream has been reached 1014, the method 1000 ends 1016.

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If the decision on whether or not to attempt upshift 1010 is "no", a decision about whether or not to downshift 1012 is made. In one embodiment, a trigger threshold  $\Theta_{down}$  is defined in a manner analogous to  $\Theta_{up}$ . If  $\varphi_{current} > \Theta_{down}$  then the stream quality may be adequate, and the agent controller module 702 does not downshift 1018 stream quality. However, if  $\varphi_{current} > \Theta_{down}$ , the agent controller module 702 does downshift 1018 the stream quality. If the end of the stream has not been reached 1014, the agent controller module 702 begins to request and receive 1004 lower quality streamlets and the method 1000 starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced by alternative streamlet monitoring solutions.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

- 1. A system for adaptive-rate content streaming of live 25 event video playable on one or more end user stations over the Internet, the system comprising:
  - at least one storage device storing live event video, the live event video encoded at a plurality of different bitrates creating a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, the low quality stream, the medium quality stream, and the high quality stream each comprising a group of streamlets encoded at a respective one of the plurality of different bitrates, each group of streamlets comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the live event video;
  - wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and
  - wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the live event video in each of the low quality stream, the medium quality stream, and the high quality stream, and wherein the first streamlet of the low quality stream encodes the same first portion of the live event video at a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream.
  - 2. The system of claim 1, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the live event video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.
  - 3. The system of claim 2, wherein the first and second durations are different.
  - 4. The system of claim 1, further comprising:
  - a plurality of web servers located at different locations across the internet, each web server configured to:
  - receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing a portion of the video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one

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of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams;

- retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and
- send the retrieved first streamlet from the currently selected one of the different copies to the requesting 10 one of the end user stations over the one or more network connections.
- **5**. The system of claim **1**, wherein each of the first streamlets has a first duration that is the range of 0.1 to 5 seconds.
- **6.** The system of claim **1**, wherein the live event is a live sports event.
  - 7. The system of claim 1, further comprising:
  - a first web server configured to:
    - receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the live event video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the live event video;
    - retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and
    - send the retrieved first streamlet from the currently 35 selected one of the low quality stream, the medium quality stream, and the high quality stream to the requesting one of the end user stations over the one or more network connections.
- **8**. The system of claim **7**, wherein the first streamlets of 40 the low quality stream, the medium quality stream, and the high quality stream are available before the live event is complete.
- **9**. The system of claim **7**, wherein the streamlets of the low quality stream, the medium quality stream, and the high 45 quality stream of the live event are available on a 10 second delay.
- 10. The system of claim 7, wherein the streamlets from the low quality stream, the medium quality stream, and the high quality stream of the live event, when played back, 50 appear live to a viewer.
- 11. The system of claim 7, wherein the first web server is further configured to:
  - receive at least one virtual timeline request over the one or more internet connections from the one or more end 55 user stations to retrieve a virtual timeline; and
  - send the virtual timeline to the requesting one of the end user stations over the one or more network connections.
- 12. The system of claim 11, wherein the virtual timeline corresponds to the currently selected one of the low quality 60 stream, the medium quality stream, and the high quality stream.
- 13. The system of claim 11, wherein the virtual timeline defines a playlist for a user to view.
- **14**. The system of claim **11**, wherein the virtual timeline 65 comprises a file that is configured to define a playlist for a user to view.

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- 15. The system of claim 11, wherein the virtual timeline comprises at least one quantum media extension (QMX).
- **16**. An end user station to stream a live event video over a network from a server for playback of the video, the content player device comprising:
  - a processor;
  - a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed, cause the processor to:
    - establish one or more network connections between the end user station and the server, wherein the server is configured to access at least one of a plurality of groups of streamlets;
      - wherein the live event video is encoded at a plurality of different bitrates to create a plurality of streams including at least a low quality stream, a medium quality stream, and a high quality stream, each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded at the same respective one of the different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the live event video;
      - wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bit rate of no less than 600 kbps; and
      - wherein the first streamlets of each of the low quality stream, the medium quality stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes the same portion of the live event video at a different one of the different bitrates;
    - select a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams:
    - place a streamlet request to the server over the one or more network connections for the first streamlet of the selected stream;
    - receive the requested first streamlet from the server via the one or more network connections; and
    - provide the received first streamlet for playback of the live event video.
- 17. The end user station of claim 16, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the live event video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.
- 18. The end user station of claim 17, wherein the first and second durations are different.
- 19. The end user station of claim 16, wherein each of the first streamlets has a first duration that is the range of 0.1 to 5 seconds.
- 20. The end user station of claim 16, wherein the first streamlets of the low quality stream, the medium quality stream, and the high quality stream are available before the live event is complete.
- 21. The end user station of claim 16, wherein the streamlets of the low quality stream, the medium quality stream, and the high quality stream of the live event are available on a ten second delay.

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- 22. The end user station of claim 16, wherein the streamlets from the low quality stream, the medium quality stream, and the high quality stream of the live event, when played back, appear live to a viewer.
- 23. The end user station of claim 16, wherein the end user 5 station is further configured to:

request and receive a virtual timeline; and

wherein one or more streamlet requests are based on the at least one virtual timeline.

- **24**. The end user station of claim **23**, wherein the virtual <sup>10</sup> timeline corresponds to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.
- 25. The end user station of claim 23, wherein the virtual timeline defines a playlist for a user to view.
- **26.** A process executable by one or more servers to stream a live event video for playback by one or more end user stations, the process comprising:
  - storing, by the one or more servers, a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the live event video;

wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and 30 wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes

the same first portion of the live event video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different one of the different bitrates than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;

receiving at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the live event video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the live event video;

retrieving from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and

sending the retrieved first streamlet from the currently 55 selected one of the low quality stream, the medium

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quality stream, and the high quality stream to the requesting one of the end user stations over the one or more network connections.

- 27. The process of claim 26, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the live event video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.
- 28. The process of claim 26, wherein the first and second durations are different.
- 29. The process of claim 26, wherein the first streamlets of the low quality stream, the medium quality stream, and the high quality stream are available before the live event is complete.
- **30**. A process executable by a content player device to stream a live event video over a network from a server for playback of the video by the content player device, the process comprising:
  - establishing one or more network connections between the content player device and the server, wherein the server accesses a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the live event video;
  - wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the live event video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;
  - selecting, by the content player device, a currently selected one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the live event video;
  - placing a streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the live event video;

receiving the requested streamlet from the server via the one or more network connections; and

rendering, by the content player device, the received streamlet for playback of the live event video.

\* \* \* \* \*

# EXHIBIT E

## (12) United States Patent

Brueck et al.

#### (54) APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

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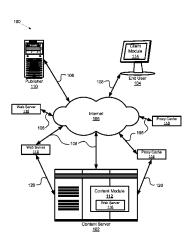
Primary Examiner — Chirag R Patel

(74) Attorney, Agent, or Firm — Lorenz & Kopf LLP

#### (57)**ABSTRACT**

An apparatus for multi-bitrate content streaming includes a receiving module configured to capture media content, a streamlet module configured to segment the media content and generate a plurality of streamlets, and an encoding module configured to generate a set of streamlets. The system includes the apparatus, wherein the set of streamlets comprises a plurality of streamlets having identical time indices and durations, and each streamlet of the set of streamlets having a unique bitrate, and wherein the encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. A method includes receiving media content, segmenting the media content and generating a plurality of streamlets, and generating a set of streamlets.

#### 27 Claims, 11 Drawing Sheets



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#### Related U.S. Application Data

No. 16/004,056, filed on Jun. 8, 2018, which is a continuation of application No. 15/414,025, filed on Jan. 24, 2017, now Pat. No. 9,998,516, which is a continuation of application No. 14/719,122, filed on May 21, 2015, now Pat. No. 9,571,551, which is a continuation of application No. 14/106,051, filed on Dec. 13, 2013, now Pat. No. 9,071,668, which is a continuation of application No. 13/617,114, filed on Sep. 14, 2012, now Pat. No. 8,612,624, which is a continuation of application No. 12/906,940, filed on Oct. 18, 2010, now Pat. No. 8,402,156, which is a continuation-in-part of application No. 11/673,483, filed on Feb. 9, 2007, now Pat. No. 7,818,444, which is a continuation-in-part of application No. 11/116, 783, filed on Apr. 28, 2005, now Pat. No. 8,868,772.

- (60) Provisional application No. 60/566,831, filed on Apr. 30, 2004.
- (51) **Int. Cl.** H04L 12/801 (2013.01)G06F 16/71 (2019.01)G06F 16/182 (2019.01)H04N 7/24 (2011.01)H04N 21/2343 (2011.01)H04N 21/433 (2011.01)H04N 21/84 (2011.01)H04N 21/845 (2011.01)H04L 29/08 (2006.01)H04N 21/2662 (2011.01)
- (52) U.S. CI.

  CPC ....... H04L 29/06027 (2013.01); H04L 47/12

  (2013.01); H04L 47/801 (2013.01); H04L

  65/1069 (2013.01); H04L 65/4069 (2013.01);

  H04L 65/608 (2013.01); H04L 65/80

  (2013.01); H04L 67/02 (2013.01); H04L

  67/2842 (2013.01); H04L 67/32 (2013.01);

  H04N 7/24 (2013.01); H04N 21/23439

  (2013.01); H04N 21/2662 (2013.01); H04N

  21/4331 (2013.01); H04N 21/84 (2013.01);
- (58) **Field of Classification Search**CPC . H04L 65/80; H04L 67/2842; H04L 65/4069;
  H04L 65/607; H04L 65/608
  See application file for complete search history.

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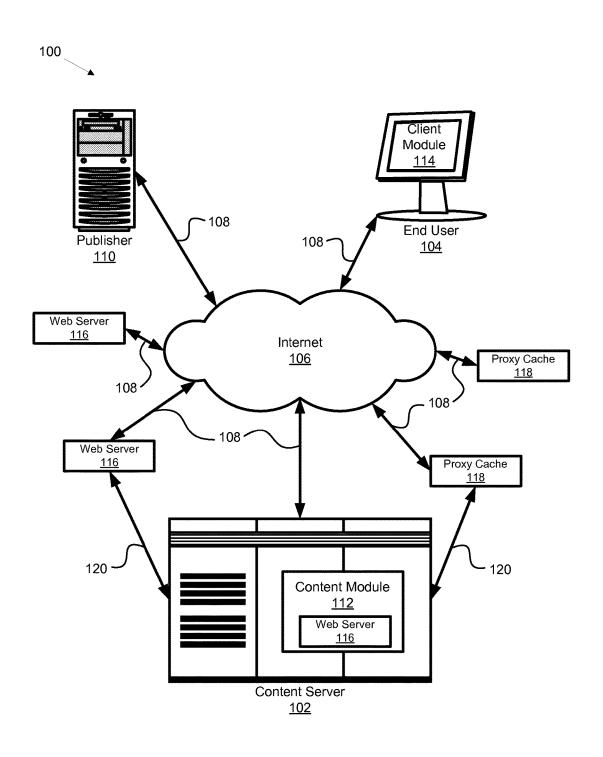


FIG. 1

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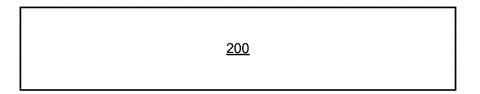


FIG. 2a

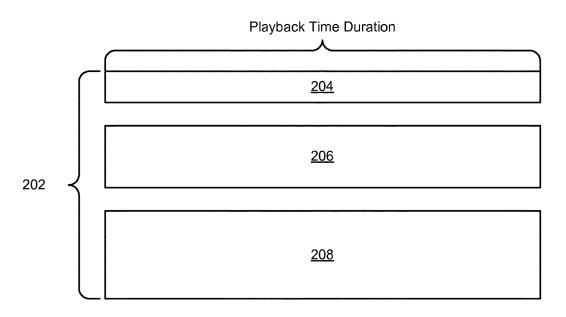
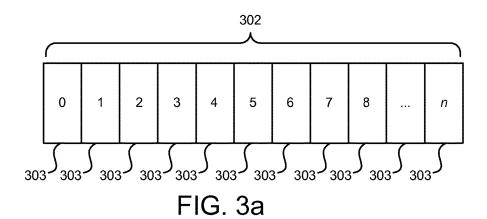


FIG. 2b

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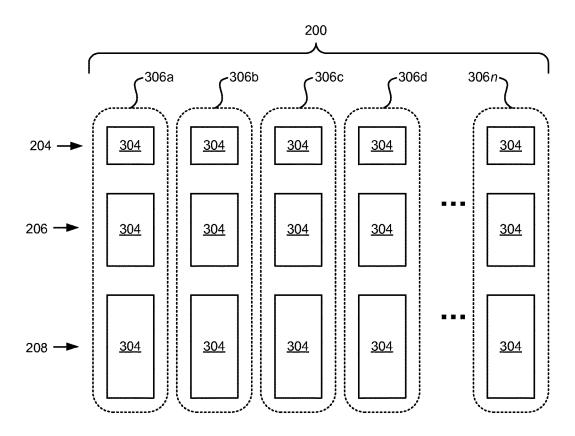
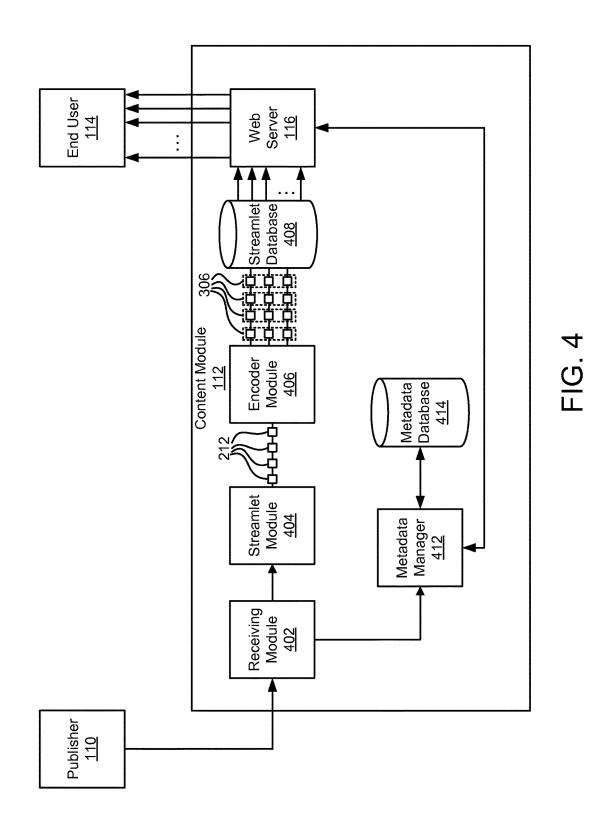


FIG. 3b

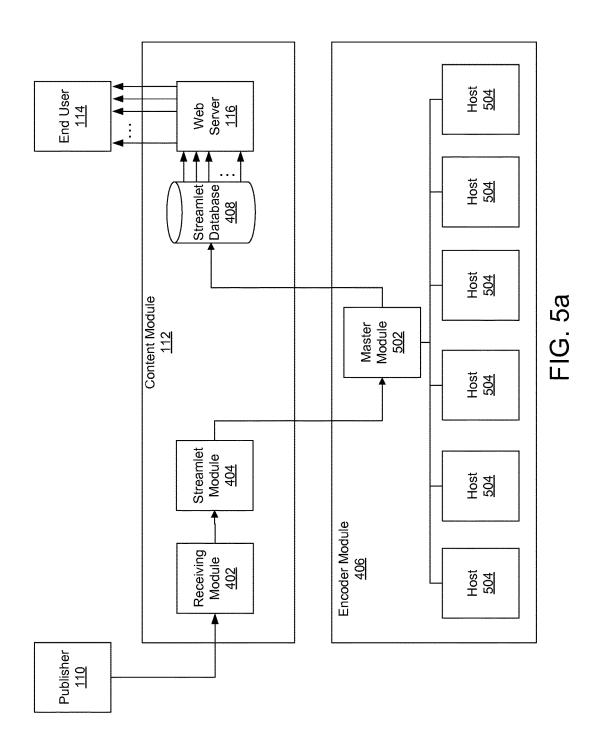
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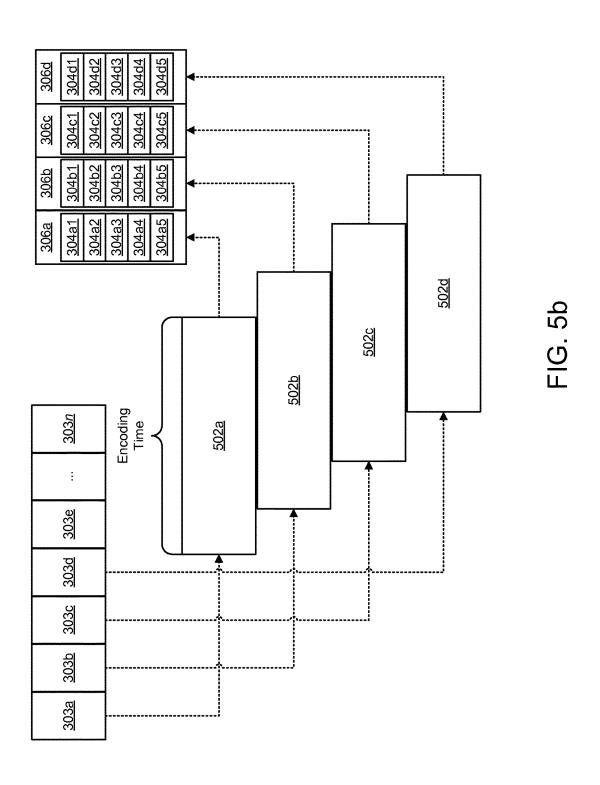
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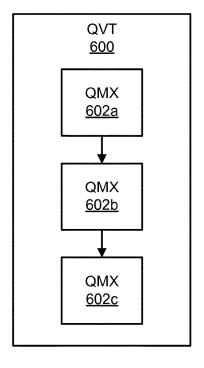
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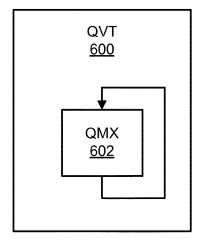


FIG. 6b

FIG. 6a

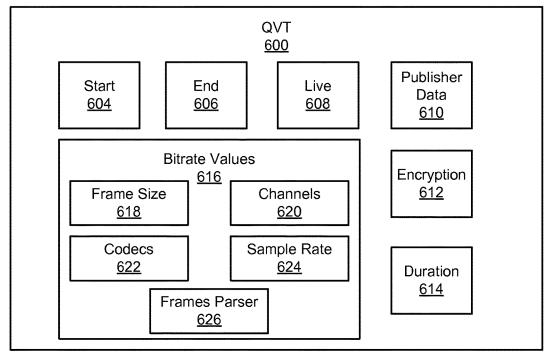
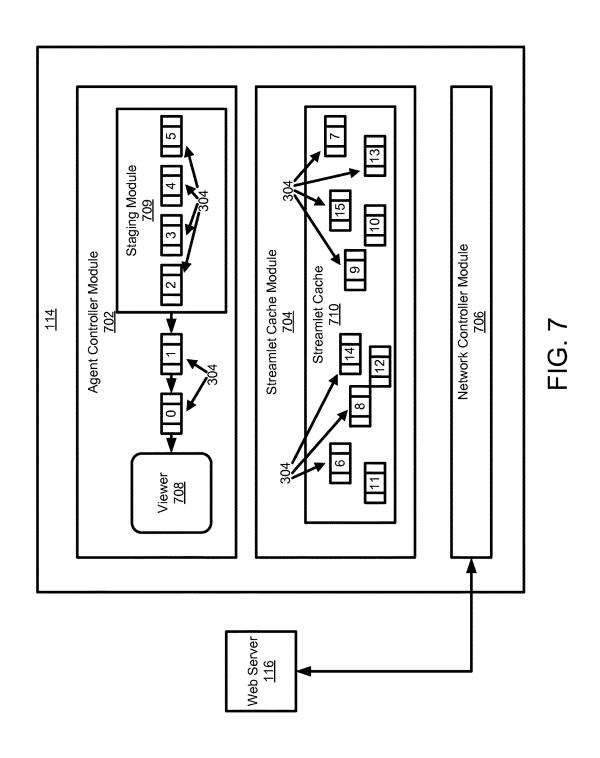


FIG. 6c

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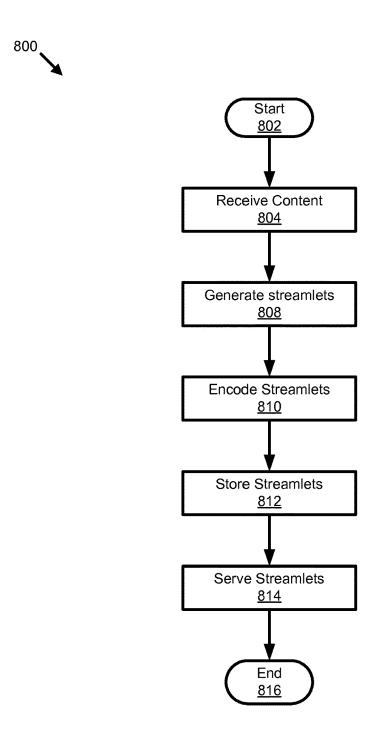


FIG. 8

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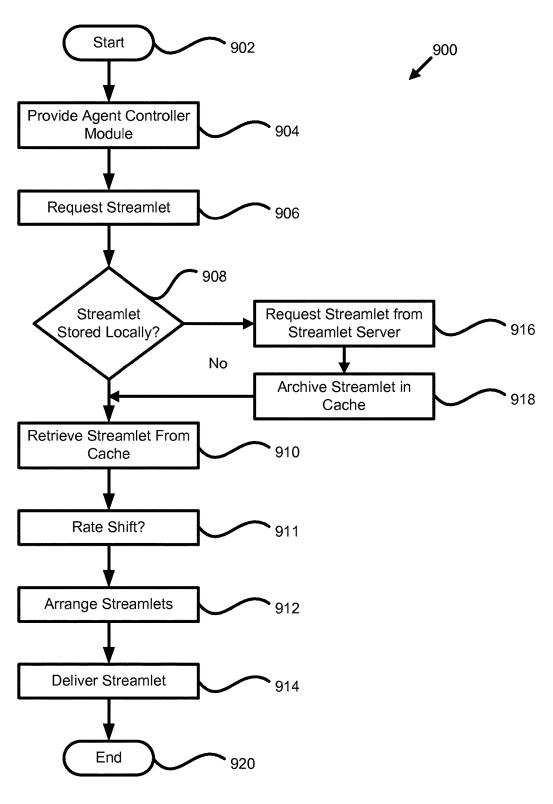
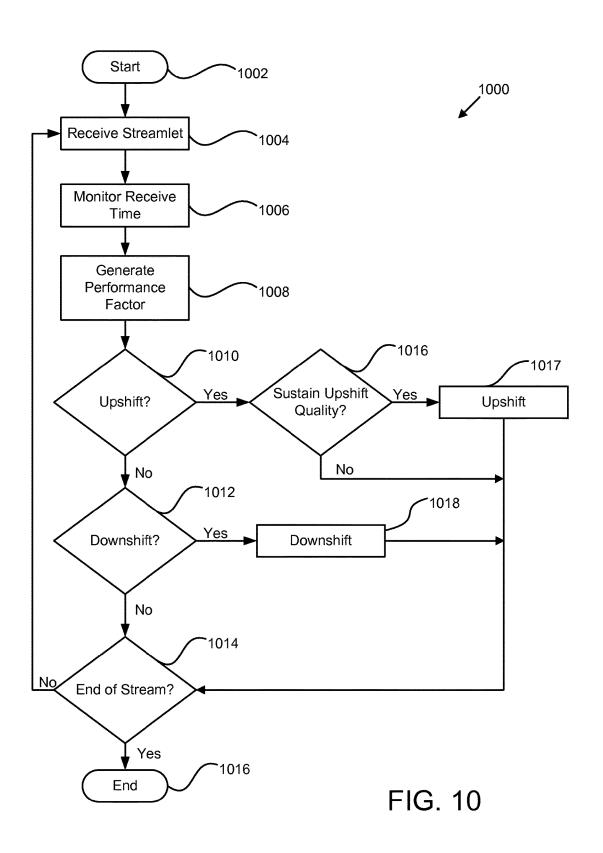


FIG. 9

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#### 1

## APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

## CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 16/004,056 filed on Jun. 8, 2018, which is a continuation of U.S. patent application Ser. No. 15/414,027 (now U.S. Pat. No. 9,998,516) filed on Jan. 24, 2017, which 10 is a continuation of U.S. patent application Ser. No. 14/719, 122 filed on May 21, 2015, which is a continuation of U.S. patent application Ser. No. 14/106,051 filed on Dec. 13, 2013 (now U.S. Pat. No. 9,071,668), which is a continuation of U.S. patent application Ser. No. 13/617,114, filed on Sep. 14, 2012 (now U.S. Pat. No. 8,612,624), which is a continuation of U.S. patent Ser. No. 12/906,940 filed on Oct. 18, 2010 (now U.S. Pat. No. 8,402,156), which is a continuation of U.S. patent application Ser. No. 11/673,483, filed on Feb. 9, 2007 (now U.S. Pat. No. 7,818,444), which is a continu- 20 ation-in-part of application Ser. No. 11/116,783, filed on Apr. 28, 2005 (now U.S. Pat. No. 8,868,772), which claims the benefit of U.S. Provisional Application No. 60/566,831, filed on Apr. 31, 2004, all of which are incorporated herein by reference.

#### BACKGROUND OF THE INVENTION

#### Field of the Invention

The invention relates to video streaming over packet switched networks such as the Internet, and more particularly relates to adaptive-rate shifting of streaming content over such networks.

### Description of the Related Art

The Internet is fast becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or 40 practically any network capable device. Many portable media players are equipped with network connections and enabled to play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a 45 server.

"Streaming media" refers to technology that delivers content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently 50 deleted. The user has the immediate satisfaction of viewing the requested content without waiting for the media file to completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network 55 connection. Streaming may be used to deliver content on demand (previously recorded) or from live broadcasts.

Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media 60 files can take large amounts of time depending on the network connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a higher quality audio/video than can be delivered in real time. 65 Users generally dislike this option, as they tend to want to see or hear the media file instantaneously.

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Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for viewing on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also vulnerable to network failures or congestion.

Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for 35 a moment and then slowly resumes the original transmission pace. This behavior is an attempt to alleviate the perceived congestion. Such a slowdown is detrimental to the viewing or listening experience of the user and therefore is not acceptable.

The second challenge to data transport is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

The third challenge is latency. Latency is the time measure form the client's point-of-view, of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput of TCP.

From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

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#### SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems. Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the above-discussed shortcomings in the art.

The apparatus for adaptive-rate content streaming is provided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include a receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, and an encoding module configured to encode each streamlet as a separate content file.

The encoding module is further configured to generate a set of streamlets for each of the sequential streamlets. Each streamlet may comprise a portion of the media content having a predetermined length of time. The predetermined length of time may be in the range of between about 0.1 and 25 5 seconds.

In one embodiment, a set of streamlets comprises a plurality of streamlets having identical time indices, and each streamlet of the set of streamlets has a unique bitrate. The receiving module is configured to convert the media 30 content to raw audio or raw video. The encoding module may include a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. The job completion bid may be based on a plurality of computing 35 variables selected from a group consisting of current encoding job completion time, processor speed, and physical memory capacity

A system of the present invention is also presented for 40 adaptive-rate content streaming. In particular, the system, in one embodiment, includes a receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, each streamlet comprising a portion of 45 the media content having a predetermined length of time, and an encoding module configured to encode each streamlet as a separate content file and generate a set of streamlets.

The system also includes a plurality of streamlets having identical time indices and each streamlet of the set of 50 streamlets having a unique bitrate. The encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid.

A method of the present invention is also presented for 55 adaptive-rate content streaming. In one embodiment, the method includes receiving media content, segmenting the media content and generating a plurality of sequential streamlets, and encoding each streamlet as a separate content file.

The method also includes segmenting the media content into a plurality of streamlets, each streamlet comprising a portion of the media content having a predetermined length of time. In one embodiment, the method includes generating a set of streamlets comprising a plurality of streamlets 65 having identical time indices, and each streamlet of the set of streamlets having a unique bitrate.

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Furthermore, the method may include converting the media content to raw audio or raw video, and segmenting the content media into a plurality of sequential streamlets. The method further comprises assigning an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid, and submitting an encoding job completion bid based on a plurality of computing variables.

Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention

These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

#### BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

FIG. 1 is a schematic block diagram illustrating one embodiment of a system for dynamic rate shifting of streaming content in accordance with the present invention;

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content file;

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth;

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of source streamlets;

FIG. 3*h* is a schematic block diagram illustrating one embodiment of sets of streamlets in accordance with the present invention;

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module in accordance with the present invention;

FIG. 5a is a schematic block diagram illustrating one embodiment of an encoder module in accordance with the present invention;

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FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention;

FIG. 6a is a schematic block diagram illustrating one embodiment of a virtual timeline in accordance with the 5 present invention:

FIG. 6b is a schematic block diagram illustrating an alternative embodiment of a VT in accordance with the present invention;

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX in accordance with the present

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with 15 the present invention;

FIG. 8 is a schematic flow chart diagram illustrating one embodiment of a method for processing content in accordance with the present invention;

FIG. 9 is a schematic flow chart diagram illustrating one 20 embodiment of a method for viewing a plurality of streamlets in accordance with the present invention; and

FIG. 10 is a schematic flow chart diagram illustrating one embodiment of a method for requesting streamlets within an adaptive-rate shifting content streaming environment in 25 accordance with the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, 35 off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or 45 function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein 55 within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely 60 as electronic signals on a system or network.

Reference throughout this specification to "one embodiment," "an embodiment," or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one 65 embodiment of the present invention. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and

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similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

Reference to a signal bearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machinereadable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device. In one embodiment, a computer program product including a computer useable medium having a computer readable program of computer instructions stored thereon that when executed on a computer causes the computer to carry out operations for multi-bitrate content streaming as described herein.

Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the inven-

FIG. 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user station 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station. 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured to present content. For example, portable electronic devices may include, but are not limited to, cellular phones, portable gaming systems, and portable computing devices.

In the depicted embodiment, the system 100 also includes a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For example, if the content to be streamed were a broadcast of a television program, the publisher 110 may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the Internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may be configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of locations simultaneously. For example, the client module 114 may request and receive content from any of the plurality of web servers 116.

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Content from the content server 102 may be replicated to other web servers 116 or alternatively to proxy cache servers 118. Replicating may occur by deliberate forwarding from the content server 102, or by a web, cache, or proxy server outside of the content server 102 asking for content on behalf of the client module 114. In a further embodiment, content may be forwarded directly to web 116 or proxy 118 servers through direct communication channels 120 without the need to traverse the Internet 106.

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content (hereinafter "content") file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Alternatively, the content file 200 may be compressed using standard or proprietary encoding schemes. Examples of encoding schemes capable of use with the present invention include, but are not limited to, DivX®, Windows Media Video®, Quicktime Sorenson 3®, On2, OGG Vorbis, MP3, or Quicktime 6.5/MPEG-4® encoded content.

FIG. 2b is a schematic block diagram illustrating one 25 embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the plurality of streams 202 comprises a low quality stream 204, a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content 30 file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and compressed to a bit rate of 100 kilobits per second (kbps), the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 35 208 may be encoded and compressed to 600 kbps.

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream 302 divided into a plurality of source streamlets 303. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 303 40 may comprise a portion of the content contained in stream 302, encapsulated as an independent media object. The content in a streamlet 303 may have a unique time index in relation to the beginning of the content contained in stream 302. In one embodiment, the content contained in each 45 streamlet 303 may have a duration of two seconds. For example, streamlet 0 may have a time index of 00:00 representing the beginning of content playback, and streamlet 1 may have a time index of 00:02, and so on. Alternatively, the time duration of the streamlets 304 may be any 50 duration smaller than the entire playback duration of the content in stream 302. In a further embodiment, the streamlets 303 may be divided according to file size instead of a time index and duration.

FIG. 3b is a schematic block diagram illustrating one 55 embodiment of sets 306 of streamlets in accordance with the present invention. As used herein, the term "set" refers to a group of streamlets having identical time indices and durations but varying bitrates. In the depicted embodiment, the set 306a encompasses all streamlets having a time index of 60 00:00. The set 306a includes encoded streamlets 304 having low, medium, and high 204, 206, 208 bitrates. Of course each set 306 may include more than the depicted three bitrates which are given by way of example only. One skilled in the art will recognize that any number of streams 65 having different bitrates may be generated from the original content 200.

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As described above, the duration of one streamlet 304 may be approximately two seconds. Likewise each set 306 may comprise a plurality of streamlets 304 where each streamlet 304 has a playable duration of two seconds. Alternatively, the duration of the streamlet 304 may be predetermined or dynamically variable depending upon a variety of factors including, but not limited to, network congestion, system specifications, playback resolution and quality, etc. In the depicted embodiment, the content 200 may be formed of the plurality of sets 306. The number of sets 306 may depend on the length of the content 200 and the length or duration of each streamlet 304.

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 112 may comprise a capture module 402, a streamlet module 404, an encoder module 406, a streamlet database 408, and the web server 116. In one embodiment, the capture module 402 is configured to receive the content file 200 from the publisher 110. The capture module 402 may be configured to "decompress" the content file 200. For example, if the content file 200 arrives having been encoded with one of the above described encoding schemes, the capture module 402 may convert the content file 200 into raw audio and/or video. Alternatively, the content file 200 may be transmitted by the publisher in a format 110 that does not require decompression.

The capture module **402** may comprise a capture card configured for TV and/or video capture. One example of a capture card suitable for use in the present invention is the DRC-2500 by Digital Rapids of Ontario, Canada. Alternatively, any capture card capable of capturing audio and video may be utilized with the present invention. In a further embodiment, the capture module **402** is configured to pass the content file to the streamlet module **404**.

The streamlet module 404, in one embodiment, is configured to segment the content file 200 and generate source streamlets 303 that are not encoded. As used herein, the term "segment" refers to an operation to generate a streamlet of the content file 200 having a duration or size equal to or less than the duration or size of the content file 200. The streamlet module 404 may be configured to segment the content file 200 into streamlets 303 each having an equal duration. Alternatively, the streamlet module 404 may be configured to segment the content file 200 into streamlets 303 having equal file sizes.

The encoding module 406 is configured to receive the source streamlets 303 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in the art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

In a further embodiment, the encoding module 406 is configured to generate a plurality of sets 306 of streamlets 304. The sets 306, as described above with reference to FIG. 3b, may comprise streamlets having an identical time index and duration, and a unique bitrate. As with FIG. 3b, the sets 306 and subsequently the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively, the plurality of streams 202 may comprise any number of streams deemed necessary to accommodate end user bandwidth.

The encoder module 406 is further configured to encode each source streamlet 303 into the plurality of streams 202 and streamlet sets 306 and store the streamlets in the streamlet database 408. The encoding module 406 may utilize encoding schemes such as DivX®, Windows Media 5 Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/MPEG-4®. Alternatively, a custom encoding scheme may be employed.

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The content module 112 may also include a metadata module 412 and a metadata database 414. In one embodi- 10 ment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be configured to define an end user environment. In 15 one embodiment, the publisher 100 may define an end user navigational environment for the content including menus, thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, pause, and play that may be used with the content file 200. 20 The metadata module 412 is configured to receive the metadata from the publisher 110 and store the metadata in the metadata database 414. In a further embodiment, the metadata module 412 is configured to interface with the client module 114, allowing the client module 114 to search 25 for content based upon at least one of a plurality of metadata criteria. Additionally, metadata may be generated by the content module 112 through automated process(es) or manual definition.

Once the streamlets **304** have been received and processed, the client module **114** may request streamlets **304** using HTTP from the web server **116**. Using a standard protocol such as HTTP eliminates the need for network administrators to configure firewalls to recognize and pass through network traffic for a new, specialized protocol. 35 Additionally, since the client module **114** initiates the request, the web server **116** is only required to retrieve and serve the requested streamlet **304**. In a further embodiment, the client module **114** may be configured to retrieve streamlets **304** from a plurality of web servers **116**.

Each web server 116 may be located in various locations across the Internet 106. The streamlets 304 may essentially be static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 304. Streamlets 304 may be served by the web server 116 or cached by cache servers of Internet Service Providers (ISPs), or any other network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution is provided that is not hindered by massive amounts of client module 114 requests to the web server 116 at any specific location, especially the web server 116 most closely associated with or within the content module 112

FIG. 5a is a schematic block diagram illustrating one 55 embodiment of an encoder module 406 in accordance with the present invention. In one embodiment, the encoder module 406 may include a master module 502 and a plurality of host computing modules (hereinafter "host") 504. The hosts 504 may comprise personal computers, 60 servers, etc. In a further embodiment, the hosts 504 may be dedicated hardware, for example, cards plugged into a single computer.

The master module (hereinafter "master") 502 is configured to receive streamlets 303 from the streamlet module 65 404 and stage the streamlet 303 for processing. In one embodiment, the master 502 may decompress each source

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streamlet 303 to produce a raw streamlet. As used herein, the term "raw streamlet" refers to a streamlet 303 that is uncompressed or lightly compressed to substantially reduce size with no significant loss in quality. A lightly compressed raw streamlet can be transmitted more quickly and to more hosts. Each host 504 is coupled with the master 502 and configured to receive a raw streamlet from the master 502 for encoding. The hosts 504, in one example, generate a plurality of streamlets 304 having identical time indices and durations, and varying bitrates. Essentially each host 504 may be configured to generate a set 306 from the raw streamlet 503 sent from the master 502. Alternatively, each host 504 may be dedicated to producing a single bitrate in order to reduce the time required for encoding.

Upon encoding completion, the host 504 returns the set 306 to the master 502 so that the encoding module 406 may store the set 306 in the streamlet database 408. The master 502 is further configured to assign encoding jobs to the hosts 504. Each host is configured to submit an encoding job completion bid (hereinafter "bid"). The master 502 assigns encoding jobs depending on the bids from the hosts 504. Each host 504 generates a bid depending upon a plurality of computing variables which may include, but are not limited to, current encoding job completion percentage, average job completion time, processor speed and physical memory capacity.

For example, a host 504 may submit a bid that indicates that based on past performance history the host 504 would be able to complete the encoding job in 15 seconds. The master 502 is configured to select from among a plurality of bids the best bid and subsequently submit the encoding job to the host 504 with the best bid. As such, the described encoding system does not require that each host 504 have identical hardware but beneficially takes advantage of the available computing power of the hosts 504. Alternatively, the master 502 selects the host 504 based on a first come first serve basis, or some other algorithm deemed suitable for a particular encoding job.

The time required to encode one streamlet 304 is dependent upon the computing power of the host 504, and the encoding requirements of the content file 200. Examples of encoding requirements may include, but are not limited to, two or multi-pass encoding, and multiple streams of different bitrates. One benefit of the present invention is the ability to perform two-pass encoding on a live content file 200. Typically, in order to perform two-pass encoding prior art systems must wait for the content file to be completed before encoding.

The present invention, however, segments the content file 200 into source streamlets 303 and the two-pass encoding to a plurality of streams 202 may be performed on each corresponding raw streamlet without waiting for a TV show to end, for example. As such, the content module 112 is capable of streaming the streamlets over the Internet shortly after the content module 112 begins capture of the content file 200. The delay between a live broadcast transmitted from the publisher 110 and the availability of the content depends on the computing power of the hosts 504.

FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention. In one example, the capture module 402 (of FIG. 4) begins to capture the content file and the streamlet module 404 generates a first streamlet 303a and passes the streamlet to the encoding module 406. The encoding module 406 may take 10 seconds, for example, to generate the first set 306a of streamlets 304a (304a1, 304a2, 304a3, etc. represent streamlets 304 of

different bitrates). FIG. 5b illustrates the encoding process generically as block 502 to graphically illustrate the time duration required to process a raw or lightly encoded streamlet 303 as described above with reference to the encoding

let 303 as described above with reference to the encoding module 406. The encoding module 406 may simultaneously process more than one streamlet 303, and processing of streamlets will begin upon arrival of the streamlet from the capture module 402.

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During the 10 seconds required to encode the first streamlet 303a, the streamlet module 404 has generated five additional 2-second streamlets 303b, 303c, 303d, 303e, 303f, for encoding and the master 502 has prepared and staged the corresponding raw streamlets. Two seconds after the first set 306a is available the next set 306b is available, and so on. As such, the content file 200 is encoded for streaming over the Internet and appears live. The 10 second delay is given herein by way of example only. Multiple hosts 504 may be added to the encoding module 406 in order to increase the processing capacity of the encoding module 406. The delay may be shortened to an almost unperceivable level by the addition of high CPU powered systems, or alternatively multiple low powered systems.

A system as described above beneficially enables multipass encoding of live events. Multi-pass encoding systems 25 of the prior art require that the entire content be captured (or be complete) because in order to perform multi-pass encoding the entire content must be scanned and processed more than once. This is impossible with prior art systems because content from a live event is not complete until the event is 30 over. As such, with prior art systems, multi-pass encoding can only be performed once the event is over. Streamlets, however, may be encoded as many times as is deemed necessary. Because the streamlet is an encapsulated media object of 2 seconds (for example), multi-pass encoding may 35 begin on a live event once the first streamlet is captured. Shortly after multi-pass encoding of the first streamlet 303a is finished, multi-pass encoding of the second streamlet 303b finishes, and as such multi-pass encoding is performed on a live event and appears live to a viewer.

Any specific encoding scheme applied to a streamlet may take longer to complete than the time duration of the streamlet itself, for example, a very high quality encoding of a 2-second streamlet may take 5 seconds to finish. Alternatively, the processing time required for each streamlet may 45 be less than the time duration of a streamlet. However, because the offset parallel encoding of successive streamlets are encoded by the encoding module at regular intervals (matching the intervals at which the those streamlets are submitted to the encoding module 406, for example 2 50 seconds) the output timing of the encoding module 406 does not fall behind the real-time submission rate of the unencoded streamlets. Conversely, prior art encoding systems rely on the very fastest computing hardware and software because the systems must generate the output immediately 55 in lock-step with the input. A prior art system that takes 2.1 seconds to encode 2 seconds worth of content is considered a failure. The present invention allows for slower than real-time encoding processes yet still achieves a real-time encoding effect due to the parallel offset pipes.

The parallel offset pipeline approach described with reference to FIG. 5b beneficially allows for long or short encoding times without "falling behind" the live event. Additionally, arbitrarily complex encoding of streamlets to multiple profiles and optimizations only lengthens the 65 encoding time 502 without a perceptible difference to a user because the sets 306 of streamlets 304 are encoded in a

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time-selective manner so that streamlets are processed at regular time intervals and transmitted at these time intervals.

Returning now to FIG. 5a, as depicted, the master 502 and the hosts 504 may be located within a single local area network, or in other terms, the hosts 504 may be in close physical proximity to the master 502. Alternatively, the hosts 504 may receive encoding jobs from the master 502 over the Internet or other communications network. For example, consider a live sports event in a remote location where it would be difficult to setup multiple hosts. In this example, a master performs no encoding or alternatively light encoding before publishing the streamlets online. The hosts 504 would then retrieve those streamlets and encode the streamlets into the multiple bitrate sets 306 as described above.

Furthermore, hosts 504 may be dynamically added or removed from the encoding module without restarting the encoding job and/or interrupting the publishing of streamlets. If a host 504 experiences a crash or some failure, its encoding work is simply reassigned to another host.

The encoding module 406, in one embodiment, may also be configured to produce streamlets that are specific to a particular playback platform. For example, for a single raw streamlet, a single host 504 may produce streamlets for different quality levels for personal computer playback, streamlets for playback on cell phones with a different, proprietary codec, a small video-only streamlet for use when playing just a thumbnail view of the stream (like in a programming guide), and a very high quality streamlet for use in archiving.

FIG. 6a is a schematic block diagram illustrating one embodiment of a virtual timeline 600 in accordance with the present invention. In one embodiment, the virtual timeline 600 comprises at least one quantum media extension 602. The quantum media extension (hereinafter "QMX") 602 describes an entire content file 200. Therefore, the virtual timeline (hereinafter "VT") 600 may comprise a file that is configured to define a playlist for a user to view. For example, the VT may indicate that the publisher desires a user to watch a first show QMX 602a followed by QMX 602b and QMX 602c. As such, the publisher may define a broadcast schedule in a manner similar to a television station.

FIG. 6b is a schematic block diagram illustrating an alternative embodiment of a VT 600 in accordance with the present invention. In the depicted embodiment, the VT 600 may include a single QMX 602 which indicates that the publisher desires the same content to be looped over and over again. For example, the publisher may wish to broadcast a never-ending infomercial on a website.

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX 602 in accordance with the present invention. In one embodiment, the QMX 602 contains a multitude of information generated by the content module 112 configured to describe the content file 200. Examples of information include, but are not limited to, start index 604, end index 606, whether the content is live 608, proprietary publisher data 610, encryption level 612, content duration 614 and bitrate values 616. The bitrate values 616 may include frame size 618, audio channel 620 information, codecs 622 used, sample rate 624, and frames parser 626.

A publisher may utilize the QVT 600 together with the QMX 602 in order to prescribe a playback order for users, or alternatively selectively edit content. For example, a publisher may indicate in the QMX 602 that audio should be muted at time index 10:42 or video should be skipped for 3 seconds at time index 18:35. As such, the publisher may

selectively skip offensive content without the processing requirements of editing the content.

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module 114 in accordance with the present invention. The client module 114 may 5 comprise an agent controller module 702, a streamlet cache module 704, and a network controller module 706. In one embodiment, the agent controller module 702 is configured to interface with a viewer 708, and transmit streamlets 304 to the viewer 708. Alternatively, the agent controller module 10 702 may be configured to simply reassemble streamlets into a single file for transfer to an external device such as a portable video player.

In a further embodiment, the client module **114** may comprise a plurality of agent controller modules **702**. Each 15 agent controller module **702** may be configured to interface with one viewer **708**. Alternatively, the agent controller module **702** may be configured to interface with a plurality of viewers **708**. The viewer **708** may be a media player (not shown) operating on a PC or handheld electronic device.

The agent controller module **702** is configured to select a quality level of streamlets to transmit to the viewer **708**. The agent controller module **702** requests lower or higher quality streams based upon continuous observation of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to FIG. **10**.

The agent controller module 702 may be configured to receive user commands from the viewer 708. Such commands may include play, fast forward, rewind, pause, and stop. In one embodiment, the agent controller module 702 requests streamlets 304 from the streamlet cache module 704 and arranges the received streamlets 304 in a staging module 709. The staging module 709 may be configured to arrange the streamlets 304 in order of ascending playback time. In the depicted embodiment, the streamlets 304 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 304 may be identified with a unique filename.

Additionally, the agent controller module 702 may be 40 configured to anticipate streamlet 304 requests and prerequest streamlets 304. By pre-requesting streamlets 304, the user may fast-forward, skip randomly, or rewind through the content and experience no buffering delay. In a further embodiment, the agent controller module 702 may request 45 the streamlets 304 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 702 may request streamlets at any interval less than the length of the time index. This enables a "fast-start" capability with no buffer- 50 ing wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 702 may be configured to pre-request streamlets 304 corresponding to specified index points within the content or within other content in anticipation of the end user 104 55 selecting new content to view. In one embodiment, the streamlet cache module 704 is configured to receive streamlet 304 requests from the agent controller module 702. Upon receiving a request, the streamlet cache module 704 first checks a streamlet cache 710 to verify if the streamlet 304 60 is present. In a further embodiment, the streamlet cache module 704 handles streamlet 304 requests from a plurality of agent controller modules 702. Alternatively, a streamlet cache module 704 may be provided for each agent controller module 702. If the requested streamlet 304 is not present in 65 the streamlet cache 410, the request is passed to the network controller module 706. In order to enable fast forward and

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rewind capabilities, the streamlet cache module 704 is configured to store the plurality of streamlets 304 in the streamlet cache 710 for a specified time period after the streamlet 304 has been viewed. However, once the streamlets 304 have been deleted, they may be requested again from the web server 116.

The network controller module 706 may be configured to receive streamlet requests from the streamlet cache module 704 and open a connection to the web server 116 or other remote streamlet 304 database (not shown). In one embodiment, the network controller module 706 opens a TCP/IP connection to the web server 116 and generates a standard HTTP GET request for the requested streamlet 304. Upon receiving the requested streamlet 304, the network controller module 706 passes the streamlet 304 to the streamlet cache module 704 where it is stored in the streamlet cache 710. In a further embodiment, the network controller module 706 is configured to process and request a plurality of streamlets 304 simultaneously. The network controller module 706 20 may also be configured to request a plurality of streamlets, where each streamlet 304 is subsequently requested in multiple parts.

In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 304 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates problems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 304. Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more useful and predictable timing.

In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by the client as a forward cache. By requesting more than one streamlet 304 at a time in a manner referred to as "parallel retrieval," or more than one part of a streamlet 304 at a time, efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 304 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection fail. Streamlet 304 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from falling into a slow-start or close mode. If the network controller module 706 has requested a streamlet 304 in multiple parts, with each part requested on mutually independent TCP/IP connections, the network controller module 706 reassembles the parts to present a complete streamlet 304 for use by all other components of the client module 114.

When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet **304**. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet **304**. If the first streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the redundant request response, the first request may be aborted.

Several streamlet 304 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This eliminates all but the first request latency. Because multiple responses are always being transmitted, the processing

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latency of each new streamlet 304 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious vulnerabilities. Transmission delays affect all of the responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

Multiple TCP connections may be opened between the client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while maintaining the independence of each streamlet 304 request. Several streamlet 304 requests may be sent concurrently, 15 with each request being sent on a mutually distinct TCP connection. This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 20 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does not affect the transmission of other responses because each response occupies an independent TCP connection. Any 25 transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding responses.

A single streamlet 304 request may be issued for an entire streamlet 304, or multiple requests may be issued, each for 30 a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by the client module 114 streamlet.

In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new 35 streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three streamlet 304 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses diminishes the net response time of the other three responses. The 45 timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to maintain the proper balance of efficiency and response times.

The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the 50 depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof, of the illustrated method. Additionally, the format and symbols 55 employed are provided to explain the logical steps of the method and are understood not to limit the scope of the method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood not to limit the scope of the corresponding method. Indeed, 60 some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumerated steps of the depicted method. Additionally, the order in which a particular method occurs 65 may or may not strictly adhere to the order of the corresponding steps shown.

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FIG. 8 is a schematic flow chart diagram illustrating one embodiment of a method 800 for processing content in accordance with the present invention. In one embodiment the method 800 starts 802, and the content module 112 receives 804 content from the publisher 110. Receiving content 804 may comprise receiving 804 a digital copy of the content file 200, or digitizing a physical copy of the content file 200. Alternatively, receiving 804 content may comprise capturing a radio, television, cable, or satellite broadcast. Once received 804, the streamlet module 404 generates 808 a plurality of source streamlets 303 each having a fixed duration. Alternatively, the streamlets 303 may be generated with a fixed file size.

In one embodiment, generating 808 streamlets comprises dividing the content file 200 into a plurality of two second streamlets 303. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202. The encoder module 406 then encodes 810 the streamlets 303 into sets 306 of streamlets 304, in a plurality of streams 202 according to an encoding scheme. The quality may be predefined, or automatically set according to end user bandwidth, or in response to pre-designated publisher guidelines

In a further embodiment, the encoding scheme comprises a proprietary codec such as WMV9®. The encoder module 406 then stores 812 the encoded streamlets 304 in the streamlet database 408. Once stored 812, the web server 116 may then serve 814 the streamlets 304. In one embodiment, serving 814 the streamlets 304 comprises receiving streamlet requests from the client module 114, retrieving the requested streamlet 304 from the streamlet database 408, and subsequently transmitting the streamlet 304 to the client module 114. The method 800 then ends 816.

FIG. 9 is a schematic flow chart diagram illustrating one embodiment of a method 900 for viewing a plurality of streamlets in accordance with the present invention. The method 900 starts and an agent controller module 702 is provided 904 and associated with a viewer 708 and provided with a staging module 709. The agent controller module 702 then requests 906 a streamlet 304 from the streamlet cache module 704. Alternatively, the agent controller module 702 may simultaneously request 906 a plurality of streamlets 304 the streamlet cache module 704. If the streamlet is stored 908 locally in the streamlet cache 710, the streamlet cache module 704 retrieves 910 the streamlet 304 and sends the streamlet to the agent controller module 702. Upon retrieving 910 or receiving a streamlet, the agent controller module 702 makes 911 a determination of whether or not to shift to a higher or lower quality stream 202. This determination will be described below in greater detail with reference to FIG. 10.

In one embodiment, the staging module 709 then arranges 912 the streamlets 304 into the proper order, and the agent controller module 702 delivers 914 the streamlets to the viewer 708. In a further embodiment, delivering 914 streamlets 304 to the end user comprises playing video and or audio streamlets on the viewer 708. If the streamlets 304 are not stored 908 locally, the streamlet request is passed to the network controller module 706. The network controller module 706 then requests 916 the streamlet 304 from the web server 116. Once the streamlet 304 is received, the network controller module 706 passes the streamlet to the streamlet cache module 704. The streamlet cache module 704 archives 918 the streamlet. Alternatively, the streamlet cache module 704 then archives 918 the streamlet and passes the streamlet to the agent controller module 702, and the method 900 then continues from operation 910 as described above.

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Referring now to FIG. 10, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 1000 for requesting streamlets 304 within an adaptive-rate shifting content streaming environment in accordance with the present invention. The method 1000 may be used in one embodiment as the operation 911 of FIG. 9. The method 1000 starts and the agent controller module 702 receives 1004 a streamlet 304 as described above with reference to FIG. 9. The agent controller module 702 then monitors 1006 the receive time of the requested streamlet. In one embodiment, the agent controller module 702 monitors the time intervals A between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given  $\Delta$  may vary substantially from another. In order to compensate for this fluctuation, the agent controller module **702** calculates **1008** a performance ratio r across a window of n samples for  $_{20}$  streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation:

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}$$

Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ratio r, the agent controller module 702 may calculate a geometric mean, or alternatively an equivalent averaging algorithm, across a window of size in, and obtain a performance factor  $\phi$ :

$$\varphi_{current} = \left(\prod_{j=1}^{m} r_j\right)^{\frac{1}{m}}$$

The policy determination about whether or not to upshift 1010 playback quality begins by comparing  $\phi_{\it current}$  with a trigger threshold  $\Theta_{up}$ . If  $\phi_{current} \ge \Theta_{up}$ , then an up shift to the next higher quality stream may be considered 1016. In one 45 embodiment, the trigger threshold  $\Theta_{up}$  is determined by a combination of factors relating to the current read ahead margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 709 for presentation at the current playback time index), and 50 a minimum safety margin. In one embodiment, the minimum safety margin may be 24 seconds. The smaller the read ahead margin, the larger  $\Theta_{up}$  is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 702 is 55 able to sustain 1016 upshift quality, then the agent controller module 702 will upshift 1017 the quality and subsequently request higher quality streams. The determination of whether use of the higher quality stream is sustainable 1016 is made by comparing an estimate of the higher quality 60 stream's performance factor,  $\varphi_{higher}$ , with  $\Theta_{up}$ . If  $\varphi_{higher} \ge \Theta_{up}$  then use of the higher quality stream is considered sustainable. If the decision of whether or not the higher stream rate is sustainable 1016 is "no," the agent controller module 702 will not attempt to upshift 1017 stream quality. 65 If the end of the stream has been reached 1014, the method 1000 ends 1016.

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If the decision on whether or not to attempt upshift 1010 is "no", a decision about whether or not to downshift 1012 is made. In one embodiment, a trigger threshold  $\Theta_{down}$  is defined in a manner analogous to  $\Theta_{up}$ . If  $\varphi_{current} > \Theta_{down}$  then the stream quality may be adequate, and the agent controller module 702 does not downshift 1018 stream quality. However, if  $\varphi_{current} \le \Theta_{down}$ , the agent controller module 702 does downshift 1018 the stream quality. If the end of the stream has not been reached 1014, the agent controller module 702 begins to request and receive 1004 lower quality streamlets and the method 1000 starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced by alternative streamlet monitoring solutions.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

- 1. A system for adaptive-rate content streaming of live event video playable on one or more end user stations over the Internet, the system comprising:
  - at least one storage device storing live event video, the live event video encoded at a plurality of different bitrates creating a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, the low quality stream, the medium quality stream, and the high quality stream each comprising a group of streamlets encoded at a respective one of the plurality of different bitrates;
  - wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps;
  - wherein the amount of data in each streamlet corresponding to the same part of the live event video in the low quality stream, the medium quality stream, and the high quality stream varies according to the different bitrates; and
  - the plurality of streamlets in the low quality stream, the medium quality stream, and the high quality stream having a duration that is the same as each other.
- 2. The system of claim 1, wherein the low quality stream is encoded at a bit rate of no greater than 100 kbps, and the medium quality stream is encoded at a bit rate between 100 kbps and 600 kbps.
- 3. The system of claim 1 wherein the streamlets in each of the high quality stream, the medium quality stream and the low quality stream are each encoded at a different one of the plurality of different bitrates.
  - 4. The system of claim 1, further comprising:
  - a plurality of web servers located at different locations across the internet, each web server configured to:

receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing a portion of the video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams;

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- retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream: and
- send the retrieved first streamlet from the currently <sup>5</sup> selected one of the different copies to the requesting one of the end user stations over the one or more network connections.
- **5**. The system of claim **1**, wherein each of the first streamlets has a first duration that is the range of 0.1 to 5 seconds.
- 6. The system of claim 1, wherein the live event is a live sports event.
  - 7. The system of claim 1, further comprising:
  - a first web server configured to:
    - receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the live event video, wherein the at least 20 one streamlet request from the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to 25 select a higher or lower bitrate version of the live event video:
    - retrieve from the storage device the requested first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the 30 high quality stream; and
    - send the retrieved first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream to the requesting one of the end user stations over the one 35 or more network connections.
- **8**. The system of claim **7**, wherein the first streamlets of the low quality stream, the medium quality stream, and the high quality stream are available before the live event is complete.
- **9**. The system of claim **7**, wherein the streamlets of the low quality stream, the medium quality stream, and the high quality stream of the live event are available on a 10 second delay.
- **10**. A content player device to stream a video over a 45 network from a server for playback of the video, the content player device comprising:
  - a processor;
  - a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, 50 when executed, cause the processor to:
    - establish one or more network connections between the client module and the server, wherein the server is configured to access at least one of a plurality of groups of streamlets;
      - wherein the video is encoded at a plurality of different bitrates to create a plurality of streams including at least a low quality stream, a medium quality stream, and a high quality stream, wherein each of the low quality stream, the medium quality stream, and the high quality stream comprises a streamlet that encodes the same portion of the video at a different one of the plurality of different bitrates:
      - wherein at least one of the low quality stream, 65 medium quality stream, and high quality stream is encoded at a bit rate of no less than 600 kbps; and

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- wherein the streamlet encoding the same portion of the video in the low quality stream has an equal playback duration as the streamlet encoding the same portion of the video in the high quality stream:
- select a specific one of the streams based upon a determination by the client module to select a higher or lower bitrate version of the streams;
- place a streamlet request to the server over the one or more network connections for the selected stream; receive the requested streamlets from the server via the one or more network connections; and
- provide the received streamlets for playback of the
- 11. The content player device of claim 10 wherein each streamlet of the plurality of streamlets in the low quality stream, the medium quality stream, and the high quality stream has a duration that is the same as each other.
- 12. The content player device of claim 10, wherein the low quality stream is encoded at a bit rate of no greater than 100 kbps and the medium quality stream is encoded at a bit rate between 100 kbps and 600 kbps.
- 13. The content player device of claim 10, wherein each streamlet of the plurality of streamlets in the low quality stream, the medium quality stream, and the high quality stream has a duration that is the range of 0.1 to 5 seconds.
- 14. The content player device of claim 10, wherein the video is a video of a live event.
- 15. The content player device of claim 14, wherein the streamlets of the low quality stream, the medium quality stream, and the high quality stream are available before the live event is complete.
- 16. The content player device of claim 15, wherein the streamlets of the low quality stream, the medium quality stream, and the high quality stream of the live event are available on a ten second delay.
- 17. The content player device of claim 16, wherein the streamlets from the low quality stream, the medium quality stream, and the high quality stream of the live event, when played back, appear live to a viewer.
- **18**. A system for adaptive-rate content streaming of live event video playable on one or more end user stations over the internet, the system comprising:
  - at least one storage device configured to store live event video, the live event video encoded at a plurality of different bit rates creating a plurality of streams including at least a low quality stream and a high quality stream;
  - the low quality stream and the high quality stream each encoding the same portion of the live event video with a streamlet that is encoded a different one of the different bit rates;
  - wherein the plurality of streamlets in the low quality stream and the plurality of streamlets in the high quality stream have durations that are equal to each other.
- 19. The system of claim 18, wherein the streamlets in each of the low quality stream and the high quality stream corresponding to the same portion of the live event video have equal durations.
- 20. The system of claim 18 wherein the plurality of streams further comprise a medium quality stream encoded at a bit rate higher than the low quality stream and lower than the high quality stream.
- 21. The system of claim 20 wherein the low quality stream is encoded at a bit rate of no less than 100 kbps, the high quality stream is encoded at a bit rate of no less than 600

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kbps, and the medium quality stream is encoded at a bit rate between 100 kbps and 600 kbps.

- 22. The system of claim 18, further comprising:
- a first web server configured to:
- receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve a streamlet storing a portion of the video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the client module to select a higher or lower bitrate version of the streams;
- retrieve from the storage device the requested streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and
- send the retrieved streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream to the requesting 20 one of the end user stations over the one or more network connections.
- 23. The system of claim 18, further comprising:
- a plurality of web servers located at different locations across the internet, each web server configured to:
- receive at least one streamlet request over one or more internet connections from the one or more end user stations to retrieve a streamlet storing a portion of the video, wherein the at least one streamlet request from the one or more end user stations includes a request for a currently selected one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the client module to select a higher or lower bitrate version of the streams;
- retrieve from the storage device the requested streamlet <sup>35</sup> from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and
- send the retrieved streamlet from the currently selected one of the different copies to the requesting one of the <sup>40</sup> end user stations over the one or more network connections.
- 24. The system of claim 21, wherein all of the streamlets in each of the low quality stream, the medium quality stream and the high quality stream have equal durations.

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- 25. The system of claim 21, wherein the streamlets of the low quality stream, the medium quality stream, and the high quality stream are available on a ten second delay before the live event is complete, wherein the streamlets from the low quality stream, the medium quality stream, and the high quality stream of the live event, when played back, appear live to a viewer.
- **26.** A content player device to stream a video over a network from a server for playback of the video, the content player device comprising:
  - a processor;
  - a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed, cause the processor to:
    - establish one or more network connections between the client module and the server, wherein the server is configured to access at least one of a plurality of groups of streamlets;
      - wherein the video is encoded at a plurality of different bitrates to create a plurality of streams including at least a low quality stream and a high quality stream,
      - the low quality stream and the high quality stream each representing the same portion of the video with a streamlets encoded at a different one of the plurality of different bitrates; and
      - wherein the streamlet representing the same portion of the video in the low quality stream and the streamlet representing the same portion of the video in the high quality stream have durations equal to each other;
    - select a specific one of the streams based upon a determination by the client module to select a higher or lower bitrate version of the streams;
    - place a streamlet request to the server over the one or more network connections for the selected stream;
    - receive the requested streamlets from the server via the one or more network connections; and
    - provide the received streamlets for playback of the
- 27. The content player device of claim 26, wherein the plurality of streamlets in the low quality stream have a duration equal to the duration of the plurality of streamlets in the high quality stream.

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# **EXHIBIT F**

## (12) United States Patent Major et al.

#### US 8,868,772 B2 (10) Patent No.: (45) Date of Patent: Oct. 21, 2014

#### (54) APPARATUS, SYSTEM, AND METHOD FOR ADAPTIVE-RATE SHIFTING OF STREAMING CONTENT

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Field of Classification Search (58)

See application file for complete search history.

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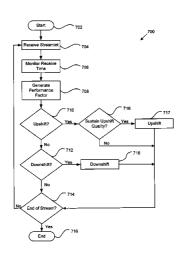
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#### (57)ABSTRACT

An apparatus for adaptive-rate shifting of streaming content includes an agent controller module configured to simultaneously request at least portions of a plurality of streamlets. The agent controller module is further configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or lower quality streamlets. A staging module is configured to stage the streamlets and arrange the streamlets for playback on a content player. A system includes a data communications network, a content server coupled to the data communications network and having a content module configured to process content and generate a plurality of high and low quality streams, and the apparatus. A method includes simultaneously requesting at least portions of a plurality of streamlets, continuously monitoring streamlet requests and subsequent responses, and accordingly requesting higher or lower quality streamlets, and staging the streamlets and arranging the streamlets for playback on a content player.

#### 21 Claims, 7 Drawing Sheets



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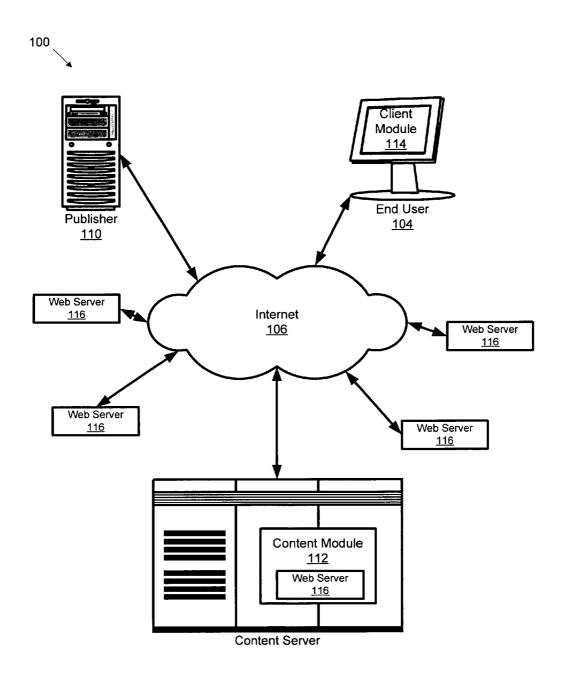
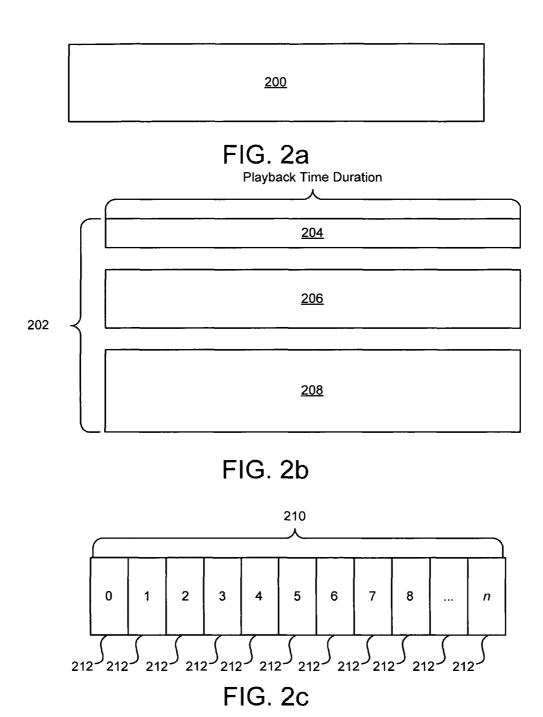


FIG. 1

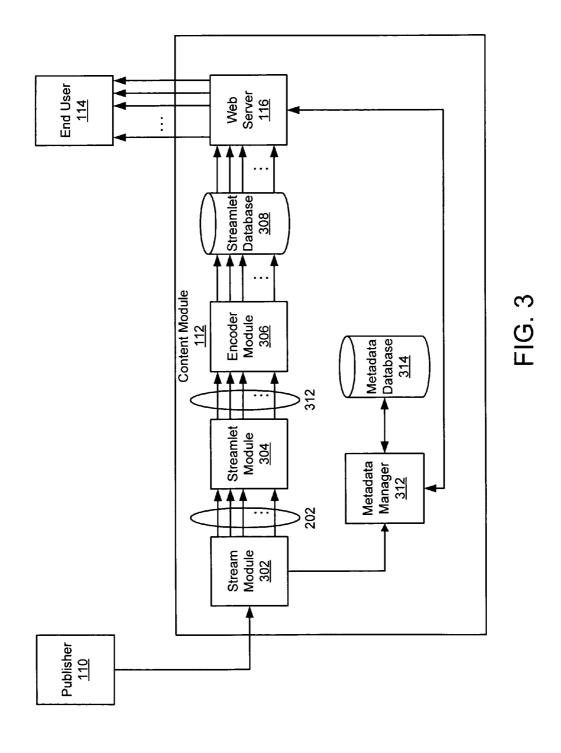
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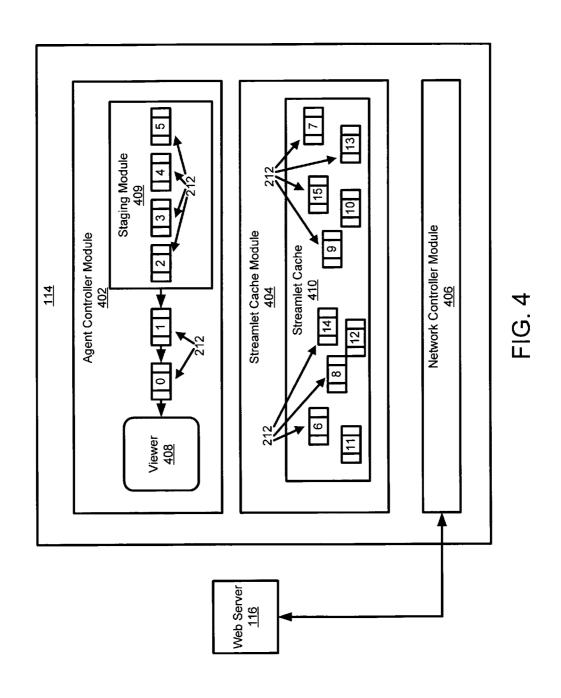
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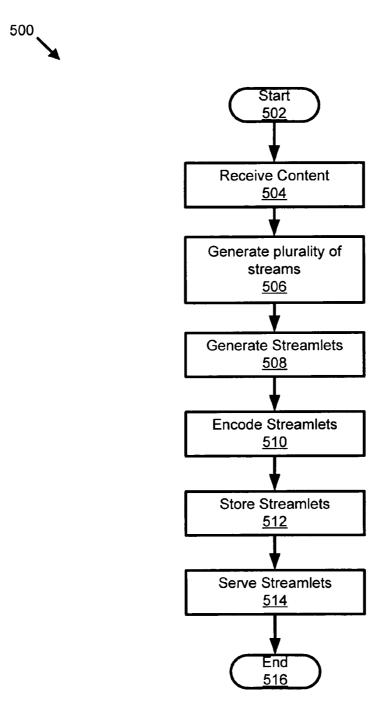


FIG. 5

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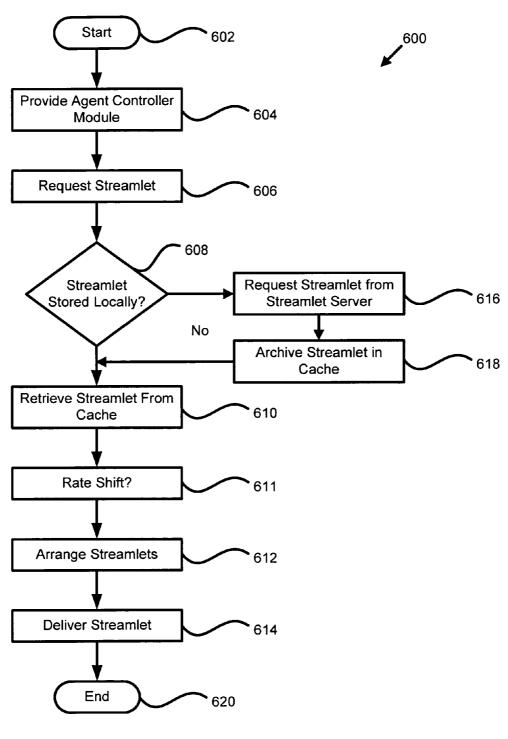
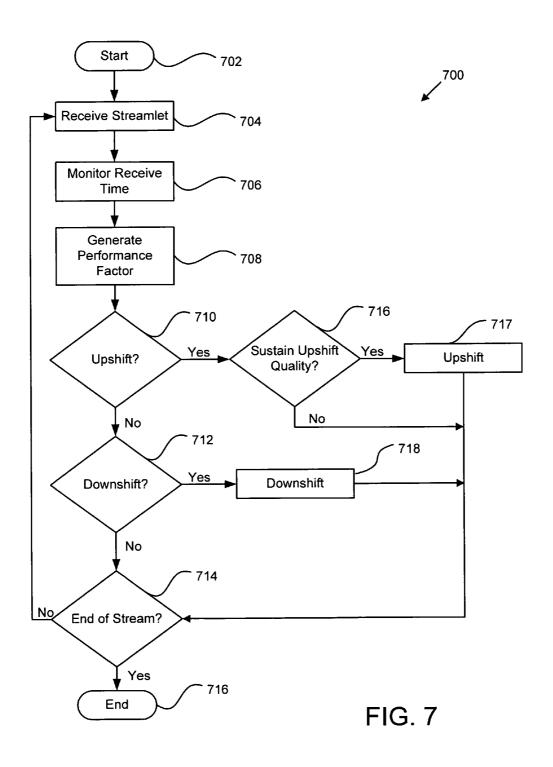


FIG. 6

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#### APPARATUS, SYSTEM, AND METHOD FOR ADAPTIVE-RATE SHIFTING OF STREAMING CONTENT

## CROSS-REFERENCES TO RELATED APPLICATIONS

This application claims benefit of U.S. Provisional Patent Application No. 60/566,831 entitled "APPARATUS, SYSTEM, AND METHOD FOR DYNAMIC RATE SHIFTING 10 OF STREAMING CONTENT" and filed on Apr. 30, 2004 for R. Drew Major and Mark B. Hurst, which is incorporated herein by reference.

#### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The invention relates to video streaming over packet switched networks such as the Internet, and more particularly relates to adaptive-rate shifting of streaming content over 20 such networks.

#### 2. Description of the Related Art

The Internet is fast becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or practically any network capable device. Many portable media players are equipped with network connections and enabled to play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a server.

"Streaming media" refers to technology that delivers content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently deleted. The user has the immediate satisfaction of viewing the requested 35 content without waiting for the media file to completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network connection. Streaming may be used to deliver content on demand (previously 40 recorded) or from live broadcasts.

Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media files can take large amounts of time depending on the network 45 connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a higher quality audio/video than can be delivered in real time. Users generally dislike this option, as they tend to want to see or hear the 50 media file instantaneously.

Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for viewing 55 on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also 60 vulnerable to network failures or congestion.

Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will

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be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the 15 data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for a moment and then slowly resumes the original transmission pace. This behavior is an attempt to alleviate the perceived congestion. Such a slowdown is detrimental to the viewing or listening experience of the user and therefore is not acceptable.

The second challenge to data transport is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

The third challenge is latency. Latency is the time measure form the client's point-of-view, of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput of TCP.

From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

#### SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems. Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the abovediscussed shortcomings in the art.

The apparatus for adaptive-rate content streaming is provided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include an agent controller module configured to simultaneously request a plurality of streamlets, the agent controller module further configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or

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lower quality streamlets, and a staging module configured to stage the streamlets and arrange the streamlets for playback on a content player.

The apparatus is further configured, in one embodiment, to establish multiple Transmission Control Protocol (TCP) connections with a content server, and request streamlets of varying bitrates. Each streamlet may further comprise a portion of a content file. Additionally, the agent controller module may be configured to generate a performance factor according to responses from streamlet requests.

In a further embodiment, the agent controller module is configured to upshift to a higher quality streamlet when the performance factor is greater than a threshold, and the agent controller module determines the higher quality playback can be sustained according to combination of factors. The factors may include an amount of contiguously available streamlets stored in the staging module, a minimum safety margin, and a current read ahead margin.

The agent controller module may be configured to down- 20 shift to a lower quality streamlet when the performance factor is less than a second threshold. Also, the agent controller module is further configured to anticipate streamlet requests and pre-request streamlets to enable fast-forward, skip randomly, and rewind functionality. In one embodiment, the 25 agent controller module is configured to initially request low quality streamlets to enable instant playback of the content file, and subsequent upshifting according to the performance factor.

A system of the present invention is also presented to 30 adaptive-rate content streaming. In particular, the system, in one embodiment, includes a data communications network, and a content server coupled to the data communications network and having a content module configured to process streams. In one embodiment, each of the high and low quality streams may include a plurality of streamlets.

In a further embodiment, the system also includes an agent controller module configured to simultaneously request a plurality of streamlets, the agent controller module further 40 configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or lower quality streamlets, and a staging module configured to stage the streamlets and arrange the streamlets for playback on a content player.

A method of the present invention is also presented for adaptive-rate content streaming. The method in the disclosed embodiments substantially includes the steps necessary to carry out the functions presented above with respect to the operation of the described apparatus and system. In one 50 embodiment, the method includes simultaneously requesting a plurality of streamlets, continuously monitoring streamlet requests and subsequent responses, and accordingly requesting higher or lower quality streamlets, and staging the streamlets and arranging the streamlets for playback on a content 55 player.

In a further embodiment, the method may include establishing multiple Transmission Control Protocol (TCP) connections with a content server, and requesting streamlets of varying bitrates. Also, the method may include generating a 60 performance factor according to responses from streamlet requests, upshifting to a higher quality streamlet when the performance factor is greater than a threshold, and determining if the higher quality playback can be sustained. Furthermore, the method may include downshifting to a lower qual- 65 ity streamlet when the performance factor is less than a second threshold.

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In one embodiment, the method includes anticipating streamlet requests and pre-requesting streamlets to enable fast-forward, skip randomly, and rewind functionality. The method may also comprise initially requesting low quality streamlets to enable instant playback of a content file, and subsequent upshifting according to the performance factor.

Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment.

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention.

These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

#### BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily content and generate a plurality of high and low quality 35 understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

> FIG. 1 is a schematic block diagram illustrating one embodiment of a system for adaptive rate shifting of streaming content in accordance with the present invention;

> FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a content file in accordance with the present invention;

> FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth in accordance with the present invention;

> FIG. 2c is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of streamlets in accordance with the present invention;

> FIG. 3 is a schematic block diagram illustrating one embodiment of a content module in accordance with the present invention;

> FIG. 4 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with the present invention;

> FIG. 5 is a schematic flow chart diagram illustrating one embodiment of a method for processing content in accordance with the present invention;

> FIG. 6 is a schematic flow chart diagram illustrating one embodiment of a method for playback of a plurality of streamlets in accordance with the present invention; and

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FIG. 7 is a schematic flow chart diagram illustrating one embodiment of a method for requesting streamlets within an adaptive-rate content streaming environment in accordance with the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise 25 disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed 30 over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The 35 operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely as electronic signals on a system or network.

Reference throughout this specification to "one embodi-40 ment," "an embodiment," or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and 45 similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

Reference to a signal bearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machine-readable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device. 55

Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known

6 structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

FIG. 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured to present content.

In the depicted embodiment, the system 100 also includes a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For example, if the content to be streamed were a broadcast of a television program, the publisher 110 may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the Internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may be configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of locations simultaneously. For example, the client module 114 may request and receive content from any of the plurality of web servers 116.

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a content file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Additionally, the content file 200 may be compressed. Examples of a compressed content file 200 include, but are not limited to, DivX®, Windows Media Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/MPEG-4® encoded content.

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the plurality of streams 202 comprises a low quality stream 204, a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and compressed to a bit rate of 100 kilobits per second (kbps), the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 208 may be encoded and compressed to 600 kbps.

FIG. 2c is a schematic block diagram illustrating one embodiment of a stream 210 divided into a plurality of streamlets 212. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 212 may comprise a portion of the content contained in stream 210, encapsulated as an independent media object. The content in a streamlet 212 may have a unique time index in relation to the beginning of the content contained in stream 210. In one embodiment, the content contained in each streamlet 212 has a duration of two seconds. For example, streamlet 0 may have

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a time index of 00:00 representing the beginning of content playback, and streamlet 1 may have a time index of 00:02, and so on. Alternatively, the time duration of the streamlets 212 may be any duration smaller than the entire playback duration of the content in stream 210. In a further embodiment, the streamlets 212 may be divided according to file size instead of a time index.

FIG. 3 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 112 may comprise a stream module 302, a streamlet module 304, an encoder module 306, a streamlet database 308, and the web server 116. In one embodiment, the stream module 302 is configured to receive the content file 200 from the publisher 110 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in the 20 art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

In the depicted embodiment, the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively, the 25 plurality of streams 202 may comprise any number of streams deemed necessary to accommodate end user bandwidth. The streamlet module 304 may be configured to receive the plurality of streams 202 from the stream module and generate a plurality of streams 312, each stream comprising a plurality 30 of streamlets 212. As described with reference to FIG. 2c, each streamlet 212 may comprise a pre-defined portion of the stream. The encoder module 306 is configured to encode each streamlet from the plurality of streams 312 and store the streamlets in the streamlet database 308. The encoding module 306 may utilize encoding schemes such as DivX®, Windows Media Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/MPEG-40®. Alternatively, a custom encoding scheme may be employed.

The content module 112 may also include a metadata mod- 40 ule 312 and a metadata database 314. In one embodiment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be 45 configured to define an end user environment. In one embodiment, the publisher 100 may define an end user navigational environment for the content including menus, thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, pause, and 50 play that may be used with the content file 200. The metadata module 312 is configured to receive the metadata from the publisher 110 and store the metadata in the metadata database **314**. In a further embodiment, the metadata module **312** is configured to interface with the client module 114, allowing 55 the client module 114 to search for content based upon at least one of a plurality of metadata criteria. Additionally, metadata may be generated by the content module 112 through automated process(es) or manual definition.

Once the streamlets 212 have been received and processed, 60 the client module 114 may request streamlets 212 using HTTP from the web server 116. Such use of client side initiated requests requires no additional configuration of firewalls. Additionally, since the client module 114 initiates the request, the web server 116 is only required to retrieve and 65 serve the requested streamlet. In a further embodiment, the client module 114 may be configured to retrieve streamlets

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212 from a plurality of web servers 310. Each web server 116 may be located in various locations across the Internet 106. The streamlets 212 are essentially static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 212. Streamlets 212 may be served by the web server 116 or cached by cache servers of Internet Service Providers (ISPs), or any other network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution is provided that is not hindered by massive amounts of client module 114 requests to the web server 116 at any specific location.

FIG. 4 is a schematic block diagram graphically illustrating one embodiment of a client module 114 in accordance with the present invention. The client module 114 may comprise an agent controller module 402, a streamlet cache module 404, and a network controller module 406. In one embodiment, the agent controller module 402 is configured to interface with a viewer 408, and transmit streamlets 212 to the viewer 408. In a further embodiment, the client module 114 may comprise a plurality of agent controller modules 402. Each agent controller module 402 may be configured to interface with one viewer 408. Alternatively, the agent controller module 402 may be configured to interface with a plurality of viewers 408. The viewer 408 may be a media player (not shown) operating on a PC or handheld electronic device.

The agent controller module **402** is configured to select a quality level of streamlets to transmit to the viewer **408**. The agent controller module **402** requests lower or higher quality streams based upon continuous observation of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to FIG. **7**.

The agent controller module 402 may be configured to receive user commands from the viewer 408. Such commands may include play, fast forward, rewind, pause, and stop. In one embodiment, the agent controller module 402 requests streamlets 212 from the streamlet cache module 404 and arranges the received streamlets 212 in a staging module 409. The staging module 409 may be configured to arrange the streamlets 212 in order of ascending playback time. In the depicted embodiment, the streamlets 212 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 212 may be identified with a unique filename.

Additionally, the agent controller module 402 may be configured to anticipate streamlet 212 requests and pre-request streamlets 212. By pre-requesting streamlets 212, the user may fast-forward, skip randomly, or rewind through the content and experience no buffering delay. In a further embodiment, the agent controller module 402 may request the streamlets 212 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 402 may request streamlets at any interval less than the length of the time index. This enables a "fast-start" capability with no buffering wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 402 may be configured to pre-request streamlets 212 corresponding to specified index points within the content or within other content in anticipation of the end user 104 selecting new content to view.

In one embodiment, the streamlet cache module 404 is configured to receive streamlet 212 requests from the agent controller module 402. Upon receiving a request, the streamlet cache module 404 first checks a streamlet cache 410 to verify if the streamlet 212 is present. In a further embodiment,

the streamlet cache module 404 handles streamlet 212 requests from a plurality of agent controller modules 402. Alternatively, a streamlet cache module 404 may be provided for each agent controller module 402. If the requested streamlet 212 is not present in the streamlet cache 410, the request is passed to the network controller module 406. In order to enable fast forward and rewind capabilities, the streamlet cache module 404 is configured to store the plurality of streamlets 212 in the streamlet cache 410 for a specified time

period after the streamlet 212 has been viewed. However,

once the streamlets 212 have been deleted, they may be

requested again from the web server 116.

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The network controller module **406** may be configured to receive streamlet requests from the streamlet cache module **404** and open a connection to the web server **116** or other remote streamlet **212** database (not shown). In one embodiment, the network controller module **406** opens a TCP/IP connection to the web server **116** and generates a standard HTTP GET request for the requested streamlet **212**. Upon receiving the requested streamlet **212**, the network controller module **406** passes the streamlet **212** to the streamlet cache module **404** where it is stored in the streamlet cache **410**. In a further embodiment, the network controller module **406** is configured to process and request a plurality of streamlets **212** 25 simultaneously. The network controller module **406** may also be configured to request a plurality of streamlets, where each streamlet **212** is subsequently requested in multiple parts.

In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 30 212 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates problems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 212. 35 Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more useful and predictable timing.

In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 40 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by the client as a forward cache. By requesting more than one streamlet 212 at a time in a manner referred to as "parallel retrieval," or more than one part of a streamlet 212 at a time, 45 efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 212 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection 50 fail. Streamlet 212 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from falling into a slow-start or close mode. If the network controller module 406 has requested a streamlet 212 in multiple parts, with each part requested on mutually inde- 55 pendent TCP/IP connections, the network controller module 406 reassembles the parts to present a complete streamlet 212 for use by all other components of the client module 114.

When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet 60 212. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet 212. If the first streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the 65 redundant request response, the first request may be aborted.

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Several streamlet 212 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This eliminates all but the first request latency. Because multiple responses are always being transmitted, the processing latency of each new streamlet 212 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious vulnerabilities. Transmission delays affect all of the responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

Multiple TCP connections may be opened between the client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while maintaining the independence of each streamlet 212 request. Several streamlet 212 requests may be sent concurrently, with each request being sent on a mutually distinct TCP connection. This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does not affect the transmission of other responses because each response occupies an independent TCP connection. Any transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding

A single streamlet 212 request may be issued for an entire streamlet 212, or multiple requests may be issued, each for a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by the client module 114 streamlet.

In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three streamlet 212 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses diminishes the net response time of the other three responses. The timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to maintain the proper balance of efficiency and response times.

The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof, of the illustrated method. Additionally, the format and symbols employed are provided to explain the logical steps of the method and are understood not to limit the scope of the method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood not to limit the scope of the corresponding method. Indeed, some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumer-

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ated steps of the depicted method. Additionally, the order in which a particular method occurs may or may not strictly adhere to the order of the corresponding steps shown.

FIG. 5 is a schematic flow chart diagram illustrating one embodiment of a method 500 for processing content in accordance with the present invention. In one embodiment the method 500 starts 502, and the content module 112 receives 504 content from the publisher 110. Receiving content 504 may comprise receiving 504 a digital copy of the content file 200, or digitizing a physical copy of the content file 200. Alternatively, receiving 504 content may comprise capturing a radio or television broadcast. Once received 504, the stream module 302 generates 506 a plurality of streams 202, each stream 202 having a different quality. The quality may be predefined, or automatically set according to end user bandwidth, or in response to pre-designated publisher guidelines.

The streamlet module 304 receives the streams 202 and generates 508 a plurality of streamlets 212. In one embodiment, generating 508 streamlets comprises dividing the 20 stream 202 into a plurality of two second streamlets 212. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202. The encoder module 306 then encodes 510 the streamlets according to a compression algorithm. In a further embodiment, the algorithm comprises 25 a proprietary codec such as WMV9®. The encoder module 306 then stores 512 the encoded streamlets in the streamlet database 308. Once stored 512, the web server 116 may then serve 514 the streamlets. In one embodiment, serving 514 the streamlets comprises receiving streamlet requests from the 30 client module 114, retrieving the requested streamlet from the streamlet database 308, and subsequently transmitting the streamlet to the client module 114. The method 500 then ends

FIG. 6 is a schematic flow chart diagram illustrating one 35 embodiment of a method 600 for viewing a plurality of streamlets in accordance with the present invention. The method 600 starts and an agent controller module 402 is provided 604 and associated with a viewer 408 and provided with a staging module 409. The agent controller module 402 40 then requests 606 a streamlet from the streamlet cache module 404. Alternatively, the agent controller module 402 may simultaneously request 606 a plurality of streamlets from the streamlet cache module 404. If the streamlet is stored 608 locally in the streamlet cache 410, the streamlet cache module 45 404 retrieves 610 the streamlet and sends the streamlet to the agent controller module 402. Upon retrieving 610 or receiving a streamlet, the agent controller module 402 makes 611 a determination of whether or not to shift to a higher or lower quality stream 202. This determination will be described 50 below in greater detail with reference to FIG. 7.

In one embodiment, the staging module 409 then arranges 612 the streamlets into the proper order, and the agent controller module 402 delivers 614 the streamlets to the viewer 408. In a further embodiment, delivering 614 streamlets to the 55 end user comprises playing video and or audio streamlets on the viewer 408. If the streamlets are not stored 608 locally, the streamlet request is passed to the network controller module 406. The network controller module 406 then requests 616 the streamlet from the web server 116. Once the streamlet is 60 received, the network controller module 406 passes the streamlet to the streamlet cache module 404. The streamlet cache module 404 archives 618 the streamlet. Alternatively, the streamlet cache module 404 then archives 618 the streamlet and passes the streamlet to the agent controller module 402, and the method 600 then continues from operation 610 as described above.

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Referring now to FIG. 7, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 700 for requesting streamlets within a adaptive-rate shifting content streaming environment in accordance with the present invention. The method 700 may be used in one embodiment as the operation 611 of FIG. 6. The method 700 starts and the agent controller module 402 receives 704 a streamlet as described above with reference to FIG. 6. The agent controller module 402 then monitors 706 the receive time of the requested streamlet. In one embodiment, the agent controller module 402 monitors the time intervals A between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given  $\Delta$  may vary substantially from another. In order to compensate for this fluctuation, the agent controller module **402** calculates **708** a performance ratio r across a window of n samples for streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}.$$

Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ratio r, the agent controller module 402 may calculate a geometric mean, or alternatively an equivalent averaging algorithm, across a window of size m, and obtain a performance factor  $\phi$ :

$$\varphi_{current} = \left(\prod_{j=1}^{m} r_j\right)^{\frac{1}{m}}.$$

The policy determination about whether or not to upshift 710 playback quality begins by comparing  $\phi_{current}$  with a trigger threshold  $\Theta_{up}$ . If  $\phi_{current} \ge \Theta_{up}$ , then an up shift to the next higher quality stream may be considered 716. In one embodiment, the trigger threshold  $\Theta_{up}$  is determined by a combination of factors relating to the current read ahead margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 409 for presentation at the current playback time index), and a minimum safety margin. In one embodiment, the minimum safety margin may be 24 seconds. The smaller the read ahead margin, the larger  $\Theta_{up}$  is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 402 is able to sustain 716 upshift quality, then the agent controller module 402 will upshift 717 the quality and subsequently request higher quality streams. The determination of whether use of the higher quality stream is sustainable 716 is made by comparing an estimate of the higher quality stream's performance factor,  $\phi_{higher}$ , with  $\Theta_{up}$ . If  $\phi_{higher} \ge \Theta_{up}$  then use of the higher quality stream is considered sustainable. If the decision of whether or not the higher stream rate is sustainable 716 is "no," the agent controller module 402 will not attempt to upshift 717 stream quality. If the end of the stream has been reached 714, the method 618 ends 716.

If the decision on whether or not to attempt upshift 710 is "no", a decision about whether or not to downshift 712 is

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made. In one embodiment, a trigger threshold  $\Theta_{down}$  down is defined in a manner analogous to  $\Theta_{up}$ . If  $\phi_{current} > \Theta_{down}$  then the stream quality may be adequate, and the agent controller module 402 does not downshift 718 stream quality. However, if  $\phi_{current} = \Theta_{down}$ , the agent controller module 402 does downshift 718 the stream quality. If the end of the stream has not been reached 714, the agent controller module 402 begins to request and receive 704 lower quality streamlets and the method 618 starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced 10 by alternative streamlet monitoring solutions.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of 15 the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

1. A method for presenting rate-adaptive streams, the method comprising:

streaming by a media player operating on an end user station a video from a set of one or more servers, wherein 25 each of a plurality of different copies of the video encoded at different bit rates is stored as multiple files on the set of servers, wherein each of the multiple files yields a different portion of the video on playback, wherein the multiple files across the different copies 30 yield the same portions of the video on playback, each of said files having a time index such that the files whose playback is the same portion of the video for each of the different copies have the same time index in relation to the beginning of the video, and wherein the streaming 35 comprises:

requesting by the media player a plurality of sequential ones of the files of one of the copies from the set of servers over a plurality of Transmission Control Protocol (TCP) connections based on the time indexes; automatically requesting by the media player from the set of servers over the plurality of TCP connections subsequent portions of the video by requesting for each such portion one of the files from one of the copies dependent upon successive determinations by the media player to shift the playback quality to a higher or lower quality one of the different copies, said automatically requesting including,

repeatedly generating a set of one or more factors indicative of the current ability to sustain the 50 streaming of the video using the files from different ones of the copies, wherein the set of one or more factors relate to the performance of the network; and

making the successive determinations to shift the 55 playback quality based on at least one of the set of factors to achieve continuous playback of the video using the files of the highest quality one of the copies determined sustainable at that time; and

presenting the video by playing back with the media 60 player on the end user station the requested files in order of ascending playback time.

2. The method of claim 1, wherein said requesting the plurality of sequential ones of the files includes requesting sub-parts of the files over different ones of the plurality of 65 TCP connections, and wherein said presenting includes reassembling the files from the received sub-parts.

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- 3. The method of claim 1, wherein said making the successive determinations to shift comprises:
  - upshifting to a higher quality one of the different copies when the at least one factor is greater than a first threshold; and
  - determining if the higher quality playback can be sustained.
- **4**. The method of claim **3**, wherein said making the successive determinations to shift comprises downshifting to a lower quality one of the different copies when the at least one factor is less than a second threshold.
  - 5. The method of claim 1, further comprising:
  - receiving user input to enable one of fast-forward, skip randomly, and rewind functionality; and
  - requesting files of the video at a specified time index that is not the next sequential time in the current playback.
  - 6. The method of claim 1,
  - wherein said requesting the plurality of sequential one of the files includes requesting the files from a low quality one of the different copies to enable instant playback of the video, and wherein said automatically requesting includes-upshifting to a higher quality one of the different copies.
- reaming by a media player operating on an end user station a video from a set of one or more servers, wherein each of a plurality of different copies of the video encoded at different bit rates is stored as multiple files on the plurality of TCP connections.

  7. The method of claim 1, wherein said requesting the plurality of sequential ones of the files includes requesting the plurality of sequential ones of the files over different ones of the plurality of TCP connections.
  - 8. The method of claim 1, wherein said presenting comprises sequentially arranging the requested files from the different copies in the order of ascending playback time for playback with the media player on the end user station.
  - 9. The method of claim 1, wherein said automatically requesting includes requesting sub-parts of the files over different ones of the plurality of TCP connections, and wherein said presenting includes reassembling the files from the received sub-parts.
  - 10. The method of claim 1, wherein the at least one of the set of factors is indicative of the available bandwidth of the plurality of TCP connections.
  - 11. The method of claim 1, wherein the at least one of the set of factors is indicative of latency of the requested files, wherein the latency is a time measure between when one of the requests is issued and a time that response data of the request begins to arrive at the end user station.
  - 12. The method of claim 1, wherein the at least one of the set of factors is indicative of time intervals between successive receive times for each response to the requested files.
  - 13. The method of claim 1, wherein the at least one of the set of factors is indicative of delays or losses in one or more of the plurality of TCP connections.
  - 14. The method of claim 1, wherein at least one of the set of servers is a web server.
  - 15. The method of claim 14, wherein the files are requested from the web server using Hyper Text Transfer Protocol (HTTP), and wherein the web server is without specialized server-side intelligence to respond to said requesting.
  - 16. The method of claim 1, wherein at least one of the set of servers is a cache server of a network infrastructure operator.
    - 17. The method of claim 1, wherein:
    - said generating the set of factors comprises:
      - monitoring time intervals between successive receive times for each of the requested files;
      - calculating a current performance ratio across a current window of the time intervals; and
      - calculating a current average of the performance ratio to obtain a current performance factor of the set of factors:

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said making further comprises:

comparing the current performance factor with a set of one or more trigger thresholds; and

determining whether to upshift or downshift to a higher or lower quality one of the different copies based on said comparing.

18. The method of claim 1, wherein said making comprises:

comparing a current performance factor of the set of factors with a set of one or more trigger thresholds, wherein the set of one or more trigger thresholds is determined by a combination of two of the set of factors relating to a current read ahead margin and a minimum safety margin, wherein the current read ahead margin is an amount of contiguously available, sequentially arranged requested files of video received by the media player for playback at a current playback time index; and

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determining whether to upshift or downshift to a higher or lower quality one of the different copies based on said comparing.

19. The method of claim 1, wherein:

said requesting comprises issuing for each of the plurality of sequential ones of the files a request with the filename of that file, and

said automatically requesting comprises issuing for each of the files a request with the filename of that file.

- 20. The method of claim 1, wherein the set of servers includes a content server storing the multiple files of the different copies, and wherein the set of servers includes one or more cache servers caching at least some of the files.
- 21. The method of claim 1, wherein the multiple files are independently cacheable by a cache server without specialized server-side intelligence.

\* \* \* \* \*

# EXHIBIT G

# (12) United States Patent

Brueck et al.

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#### (54) APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

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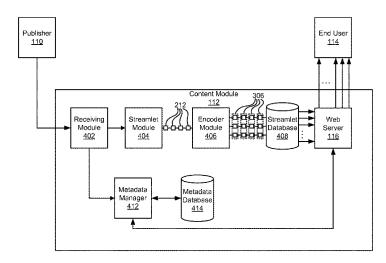
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#### (57)ABSTRACT

An apparatus for multi-bitrate content streaming includes a receiving module configured to capture media content, a streamlet module configured to segment the media content and generate a plurality of streamlets, and an encoding module configured to generate a set of streamlets. The system includes the apparatus, wherein the set of streamlets comprises a plurality of streamlets having identical time indices and durations, and each streamlet of the set of streamlets having a unique bitrate, and wherein the encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. A method includes receiving media content, segmenting the media content and generating a plurality of streamlets, and generating a set of streamlets.

#### 30 Claims, 11 Drawing Sheets



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continuation of application No. 15/414,025, filed on Jan. 24, 2017, now Pat. No. 9,998,516, which is a continuation of application No. 14/719,122, filed on May 21, 2015, now Pat. No. 9,571,551, which is a continuation of application No. 14/106,051, filed on Dec. 13, 2013, now Pat. No. 9,071,668, which is a continuation of application No. 13/617,114, filed on Sep. 14, 2012, now Pat. No. 8,612,624, which is a continuation of application No. 12/906,940, filed on Oct. 18, 2010, now Pat. No. 8,402,156, which is a continuation of application No. 11/673,483, filed on Feb. 9, 2007, now Pat. No. 7,818,444, which is a continuation-in-part of application No. 11/116,783, filed on Apr. 28, 2005, now Pat. No. 8,868,772.

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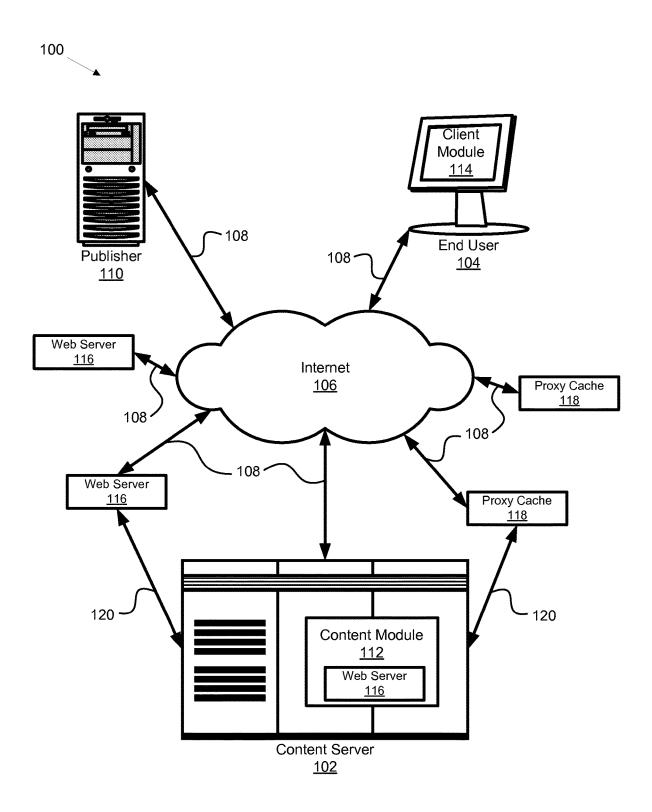


FIG. 1

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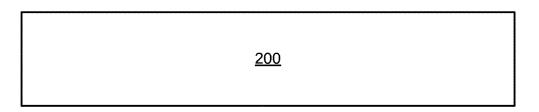


FIG. 2a

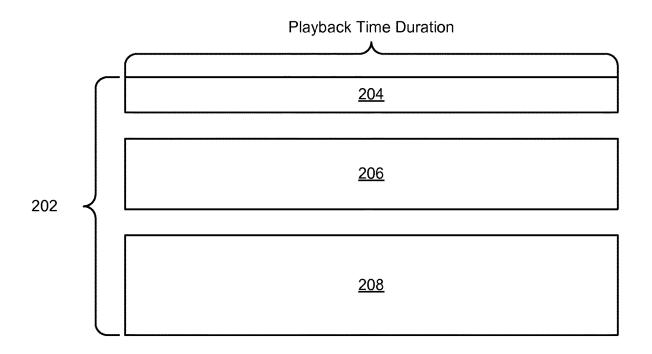


FIG. 2b

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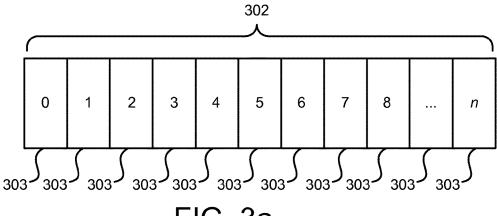


FIG. 3a

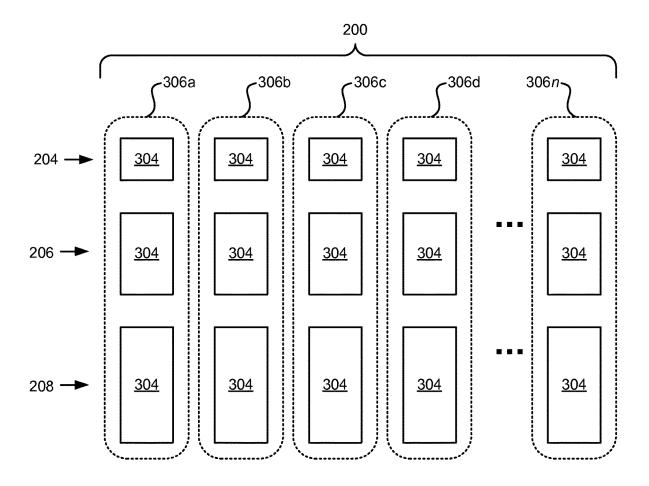


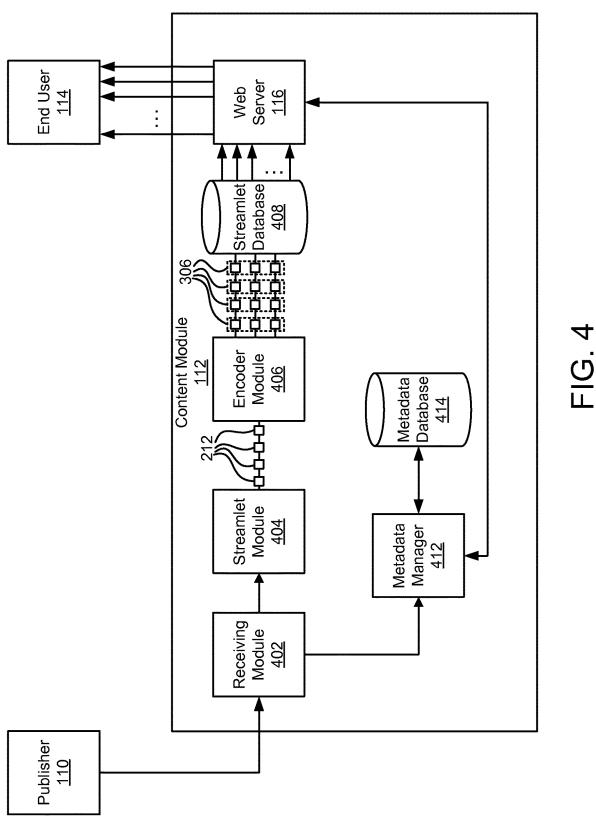
FIG. 3b

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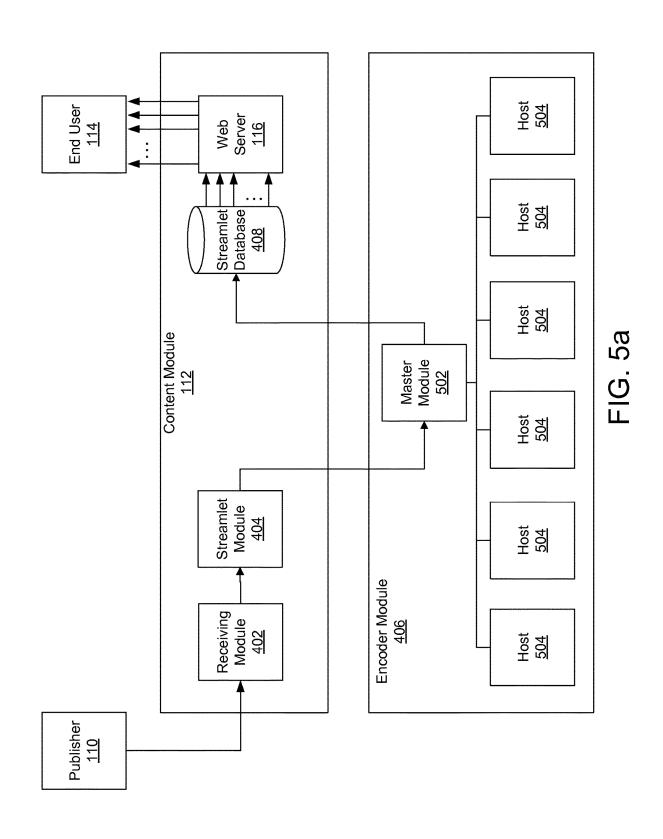
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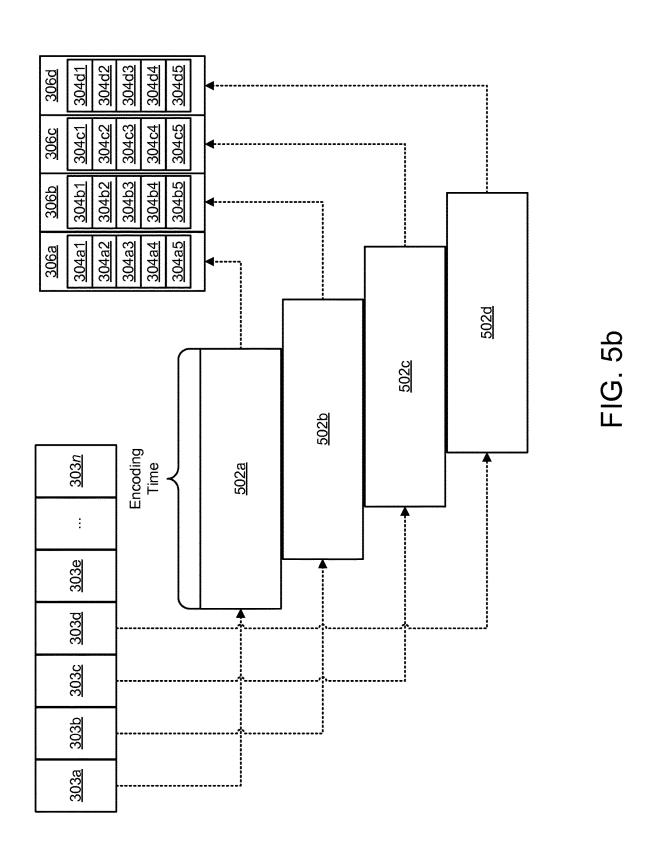
Oct. 11, 2022

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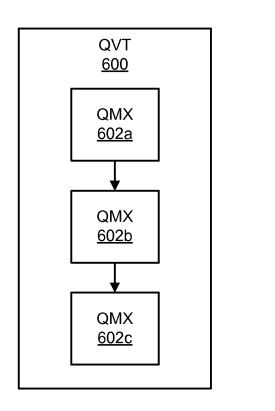


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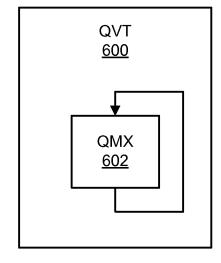


FIG. 6b

FIG. 6a

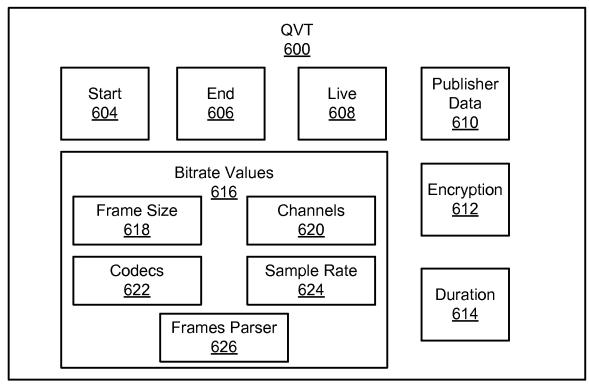
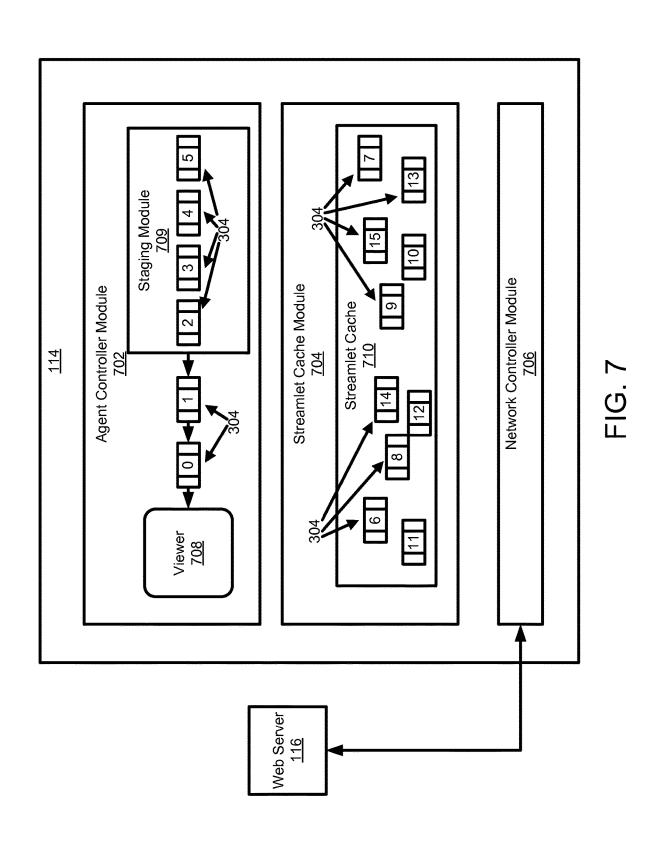


FIG. 6c

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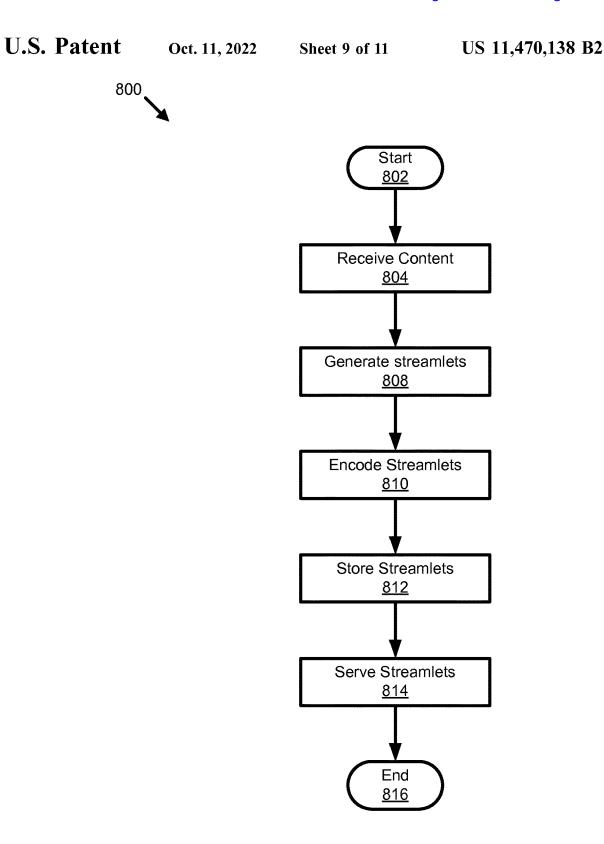


FIG. 8

U.S. Patent Oct. 11, 2022 US 11,470,138 B2 **Sheet 10 of 11** Start 902 900 Provide Agent Controller 904 Module Request Streamlet 906 908 Streamlet Request Streamlet from Stored Locally? 916 Streamlet Server No Archive Streamlet in 918 Cache Retrieve Streamlet From 910 Cache Rate Shift? 911

FIG. 9

920

912

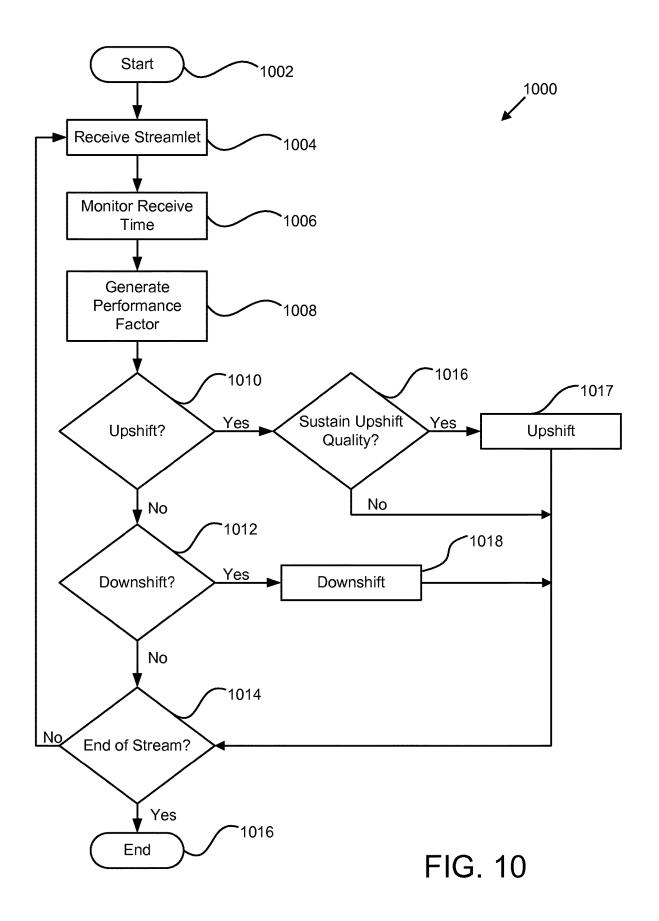
914

Arrange Streamlets

**Deliver Streamlet** 

End

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#### 1

# APPARATUS, SYSTEM, AND METHOD FOR MULTI-BITRATE CONTENT STREAMING

# CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 16/004,056 filed on Jun. 8, 2018, which is a continuation of U.S. patent application Ser. No. 15/414,025 (now U.S. Pat. No. 9,998,516) filed on Jan. 24, 2017, which 10 is a continuation of U.S. patent application Ser. No. 14/719, 122 filed on May 21, 2015, which is a continuation of U.S. patent application Ser. No. 14/106,051 filed on Dec. 13, 2013 (now U.S. Pat. No. 9,071,668), which is a continuation of U.S. patent application Ser. No. 13/617,114, filed on Sep. 14, 2012 (now U.S. Pat. No. 8,612,624), which is a continuation of U.S. patent Ser. No. 12/906,940 filed on Oct. 18, 2010 (now U.S. Pat. No. 8,402,156), which is a continuation of U.S. patent application Ser. No. 11/673,483, filed on Feb. 9, 2007 (now U.S. Pat. No. 7,818,444), which is a continu- 20 ation-in-part of application Ser. No. 11/116,783, filed on Apr. 28, 2005 (now U.S. Pat. No. 8,868,772), which claims the benefit of U.S. Provisional Application No. 60/566,831, filed on Apr. 31, 2004, all of which are incorporated herein by reference.

#### BACKGROUND OF THE INVENTION

#### Field of the Invention

The invention relates to video streaming over packet switched networks such as the Internet, and more particularly relates to adaptive-rate shifting of streaming content over such networks.

#### Description of the Related Art

The Internet is fast becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or 40 practically any network capable device. Many portable media players are equipped with network connections and enabled to play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a 45 server.

"Streaming media" refers to technology that delivers content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently 50 deleted. The user has the immediate satisfaction of viewing the requested content without waiting for the media file to completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network 55 connection. Streaming may be used to deliver content on demand (previously recorded) or from live broadcasts.

Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media 60 files can take large amounts of time depending on the network connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a higher quality audio/video than can be delivered in real time. 65 Users generally dislike this option, as they tend to want to see or hear the media file instantaneously.

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Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for viewing on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also vulnerable to network failures or congestion.

Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for 35 a moment and then slowly resumes the original transmission pace. This behavior is an attempt to alleviate the perceived congestion. Such a slowdown is detrimental to the viewing or listening experience of the user and therefore is not acceptable.

The second challenge to data transport is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

The third challenge is latency. Latency is the time measure form the client's point-of-view, of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput of TCP

From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

1

#### SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems. Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the above-discussed shortcomings in the art.

The apparatus for adaptive-rate content streaming is provided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include a receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, and an encoding module configured to encode each streamlet as a separate content file.

The encoding module is further configured to generate a set of streamlets for each of the sequential streamlets. Each streamlet may comprise a portion of the media content having a predetermined length of time. The predetermined length of time may be in the range of between about 0.1 and 25 seconds.

In one embodiment, a set of streamlets comprises a plurality of streamlets having identical time indices, and each streamlet of the set of streamlets has a unique bitrate. The receiving module is configured to convert the media 30 content to raw audio or raw video. The encoding module may include a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid. The job completion bid may be based on a plurality of computing 35 variables selected from a group consisting of current encoding job completion time, processor speed, and physical memory capacity

A system of the present invention is also presented for 40 adaptive-rate content streaming. In particular, the system, in one embodiment, includes a receiving module configured to receive media content, a streamlet module configured to segment the media content and generate a plurality of sequential streamlets, each streamlet comprising a portion of 45 the media content having a predetermined length of time, and an encoding module configured to encode each streamlet as a separate content file and generate a set of streamlets.

The system also includes a plurality of streamlets having identical time indices and each streamlet of the set of 50 streamlets having a unique bitrate. The encoding module comprises a master module configured to assign an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid.

A method of the present invention is also presented for 55 adaptive-rate content streaming. In one embodiment, the method includes receiving media content, segmenting the media content and generating a plurality of sequential streamlets, and encoding each streamlet as a separate content file.

The method also includes segmenting the media content into a plurality of streamlets, each streamlet comprising a portion of the media content having a predetermined length of time. In one embodiment, the method includes generating a set of streamlets comprising a plurality of streamlets 65 having identical time indices, and each streamlet of the set of streamlets having a unique bitrate.

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Furthermore, the method may include converting the media content to raw audio or raw video, and segmenting the content media into a plurality of sequential streamlets. The method further comprises assigning an encoding job to one of a plurality of host computing modules in response to an encoding job completion bid, and submitting an encoding job completion bid based on a plurality of computing variables.

Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment.

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodiments of the invention.

These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

#### BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily understood, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

FIG. 1 is a schematic block diagram illustrating one embodiment of a system for dynamic rate shifting of streaming content in accordance with the present invention;

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content file;

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth;

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of source streamlets;

FIG. 3b is a schematic block diagram illustrating one embodiment of sets of streamlets in accordance with the present invention;

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module in accordance with the present invention;

FIG. 5a is a schematic block diagram illustrating one embodiment of an encoder module in accordance with the present invention;

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FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention;

FIG. **6***a* is a schematic block diagram illustrating one embodiment of a virtual timeline in accordance with the <sup>5</sup> present invention;

FIG. **6***b* is a schematic block diagram illustrating an alternative embodiment of a VT in accordance with the present invention;

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX in accordance with the present invention:

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with  $_{15}$  the present invention;

FIG. **8** is a schematic flow chart diagram illustrating one embodiment of a method for processing content in accordance with the present invention;

FIG.  $\bf 9$  is a schematic flow chart diagram illustrating one  $_{20}$  embodiment of a method for viewing a plurality of streamlets in accordance with the present invention; and

FIG. **10** is a schematic flow chart diagram illustrating one embodiment of a method for requesting streamlets within an adaptive-rate shifting content streaming environment in <sup>25</sup> accordance with the present invention.

# DETAILED DESCRIPTION OF THE INVENTION

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, 35 off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or 45 function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein 55 within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely 60 as electronic signals on a system or network.

Reference throughout this specification to "one embodiment," "an embodiment." or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one 65 embodiment of the present invention. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and

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similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

Reference to a signal bearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machine-readable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device. In one embodiment, a computer program product including a computer useable medium having a computer readable program of computer instructions stored thereon that when executed on a computer causes the computer to carry out operations for multi-bitrate content streaming as described herein.

Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

FIG. 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user station 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured to present content. For example, portable electronic devices may include, but are not limited to, cellular phones, portable gaming systems, and portable computing devices.

In the depicted embodiment, the system 100 also includes a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For example, if the content to be streamed were a broadcast of a television program, the publisher 110 may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the Internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may be configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of locations simultaneously. For example, the client module 114 may request and receive content from any of the plurality of web servers 116.

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Content from the content server 102 may be replicated to other web servers 116 or alternatively to proxy cache servers 118. Replicating may occur by deliberate forwarding from the content server 102, or by a web, cache, or proxy server outside of the content server 102 asking for content on behalf of the client module 114. In a further embodiment, content may be forwarded directly to web 116 or proxy 118 servers through direct communication channels 120 without the need to traverse the Internet 106.

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a media content (hereinafter "content") file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Alternatively, the content file 200 may be compressed using standard or proprietary encoding schemes. Examples of encoding schemes capable of use with the present invention include, but are not limited to, DivX®, Windows Media Video®, Quicktime Sorenson 3®, On2, OGG Vorbis, MP3, or Quicktime 6.5/MPEG-4® encoded content.

FIG. 2b is a schematic block diagram illustrating one 25 embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the plurality of streams 202 comprises a low quality stream 204, a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content 30 file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and compressed to a bit rate of 100 kilobits per second (kbps), the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 35 208 may be encoded and compressed to 600 kbps.

FIG. 3a is a schematic block diagram illustrating one embodiment of a stream 302 divided into a plurality of source streamlets 303. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 303 40 may comprise a portion of the content contained in stream 302, encapsulated as an independent media object. The content in a streamlet 303 may have a unique time index in relation to the beginning of the content contained in stream 302. In one embodiment, the content contained in each 45 streamlet 303 may have a duration of two seconds. For example, streamlet 0 may have a time index of 00:00 representing the beginning of content playback, and streamlet 1 may have a time index of 00:02, and so on. Alternatively, the time duration of the streamlets 304 may be any 50 duration smaller than the entire playback duration of the content in stream 302. In a further embodiment, the streamlets 303 may be divided according to file size instead of a time index and duration.

FIG. 3b is a schematic block diagram illustrating one 55 embodiment of sets 306 of streamlets in accordance with the present invention. As used herein, the term "set" refers to a group of streamlets having identical time indices and durations but varying bitrates. In the depicted embodiment, the set 306a encompasses all streamlets having a time index of 60 00:00. The set 306a includes encoded streamlets 304 having low, medium, and high 204, 206, 208 bitrates. Of course each set 306 may include more than the depicted three bitrates which are given by way of example only. One skilled in the art will recognize that any number of streams 65 having different bitrates may be generated from the original content 200.

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As described above, the duration of one streamlet 304 may be approximately two seconds. Likewise each set 306 may comprise a plurality of streamlets 304 where each streamlet 304 has a playable duration of two seconds. Alternatively, the duration of the streamlet 304 may be predetermined or dynamically variable depending upon a variety of factors including, but not limited to, network congestion, system specifications, playback resolution and quality, etc. In the depicted embodiment, the content 200 may be formed of the plurality of sets 306. The number of sets 306 may depend on the length of the content 200 and the length or duration of each streamlet 304.

FIG. 4 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 112 may comprise a capture module 402, a streamlet module 404, an encoder module 406, a streamlet database 408, and the web server 116. In one embodiment, the capture module 402 is configured to receive the content file 200 from the publisher 110. The capture module 402 may be configured to "decompress" the content file 200. For example, if the content file 200 arrives having been encoded with one of the above described encoding schemes, the capture module 402 may convert the content file 200 into raw audio and/or video. Alternatively, the content file 200 may be transmitted by the publisher in a format 110 that does not require decompression.

The capture module **402** may comprise a capture card configured for TV and/or video capture. One example of a capture card suitable for use in the present invention is the DRC-2500 by Digital Rapids of Ontario, Canada. Alternatively, any capture card capable of capturing audio and video may be utilized with the present invention. In a further embodiment, the capture module **402** is configured to pass the content file to the streamlet module **404**.

The streamlet module 404, in one embodiment, is configured to segment the content file 200 and generate source streamlets 303 that are not encoded. As used herein, the term "segment" refers to an operation to generate a streamlet of the content file 200 having a duration or size equal to or less than the duration or size of the content file 200. The streamlet module 404 may be configured to segment the content file 200 into streamlets 303 each having an equal duration. Alternatively, the streamlet module 404 may be configured to segment the content file 200 into streamlets 303 having equal file sizes.

The encoding module 406 is configured to receive the source streamlets 303 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in the art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

In a further embodiment, the encoding module 406 is configured to generate a plurality of sets 306 of streamlets 304. The sets 306, as described above with reference to FIG. 3b, may comprise streamlets having an identical time index and duration, and a unique bitrate. As with FIG. 3b, the sets 306 and subsequently the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively, the plurality of streams 202 may comprise any number of streams deemed necessary to accommodate end user bandwidth.

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The encoder module 406 is further configured to encode each source streamlet 303 into the plurality of streams 202 and streamlet sets 306 and store the streamlets in the streamlet database 408. The encoding module 406 may utilize encoding schemes such as DivX®, Windows Media 5 Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/MPEG-4®. Alternatively, a custom encoding scheme may be employed.

The content module 112 may also include a metadata module 412 and a metadata database 414. In one embodi- 10 ment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be configured to define an end user environment. In 15 one embodiment, the publisher 100 may define an end user navigational environment for the content including menus, thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, pause, and play that may be used with the content file 200. 20 The metadata module 412 is configured to receive the metadata from the publisher 110 and store the metadata in the metadata database 414. In a further embodiment, the metadata module 412 is configured to interface with the client module 114, allowing the client module 114 to search 25 for content based upon at least one of a plurality of metadata criteria. Additionally, metadata may be generated by the content module 112 through automated process(es) or manual definition.

Once the streamlets 304 have been received and processed, the client module 114 may request streamlets 304 using HTTP from the web server 116. Using a standard protocol such as HTTP eliminates the need for network administrators to configure firewalls to recognize and pass through network traffic for a new, specialized protocol. 35 Additionally, since the client module 114 initiates the request, the web server 116 is only required to retrieve and serve the requested streamlet 304. In a further embodiment, the client module 114 may be configured to retrieve streamlets 304 from a plurality of web servers 116.

Each web server 116 may be located in various locations across the Internet 106. The streamlets 304 may essentially be static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 304. Streamlets 304 may be served by the 45 web server 116 or cached by cache servers of Internet Service Providers (ISPs), or any other network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution 50 is provided that is not hindered by massive amounts of client module 114 requests to the web server 116 at any specific location, especially the web server 116 most closely associated with or within the content module 112

FIG. 5a is a schematic block diagram illustrating one 55 embodiment of an encoder module 406 in accordance with the present invention. In one embodiment, the encoder module 406 may include a master module 502 and a plurality of host computing modules (hereinafter "host") 504. The hosts 504 may comprise personal computers, 60 servers, etc. In a further embodiment, the hosts 504 may be dedicated hardware, for example, cards plugged into a single computer.

The master module (hereinafter "master") 502 is configured to receive streamlets 303 from the streamlet module 65 404 and stage the streamlet 303 for processing. In one embodiment, the master 502 may decompress each source

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streamlet 303 to produce a raw streamlet. As used herein, the term "raw streamlet" refers to a streamlet 303 that is uncompressed or lightly compressed to substantially reduce size with no significant loss in quality. A lightly compressed raw streamlet can be transmitted more quickly and to more hosts. Each host 504 is coupled with the master 502 and configured to receive a raw streamlet from the master 502 for encoding. The hosts 504, in one example, generate a plurality of streamlets 304 having identical time indices and durations, and varying bitrates. Essentially each host 504 may be configured to generate a set 306 from the raw streamlet 503 sent from the master 502. Alternatively, each host 504 may be dedicated to producing a single bitrate in order to reduce the time required for encoding.

Upon encoding completion, the host 504 returns the set 306 to the master 502 so that the encoding module 406 may store the set 306 in the streamlet database 408. The master 502 is further configured to assign encoding jobs to the hosts 504. Each host is configured to submit an encoding job completion bid (hereinafter "bid"). The master 502 assigns encoding jobs depending on the bids from the hosts 504. Each host 504 generates a bid depending upon a plurality of computing variables which may include, but are not limited to, current encoding job completion percentage, average job completion time, processor speed and physical memory capacity.

For example, a host 504 may submit a bid that indicates that based on past performance history the host 504 would be able to complete the encoding job in 15 seconds. The master 502 is configured to select from among a plurality of bids the best bid and subsequently submit the encoding job to the host 504 with the best bid. As such, the described encoding system does not require that each host 504 have identical hardware but beneficially takes advantage of the available computing power of the hosts 504. Alternatively, the master 502 selects the host 504 based on a first come first serve basis, or some other algorithm deemed suitable for a particular encoding job.

The time required to encode one streamlet 304 is dependent upon the computing power of the host 504, and the encoding requirements of the content file 200. Examples of encoding requirements may include, but are not limited to, two or multi-pass encoding, and multiple streams of different bitrates. One benefit of the present invention is the ability to perform two-pass encoding on a live content file 200. Typically, in order to perform two-pass encoding prior art systems must wait for the content file to be completed before encoding.

The present invention, however, segments the content file 200 into source streamlets 303 and the two-pass encoding to a plurality of streams 202 may be performed on each corresponding raw streamlet without waiting for a TV show to end, for example. As such, the content module 112 is capable of streaming the streamlets over the Internet shortly after the content module 112 begins capture of the content file 200. The delay between a live broadcast transmitted from the publisher 110 and the availability of the content depends on the computing power of the hosts 504.

FIG. 5b is a schematic block diagram illustrating one embodiment of parallel encoding of streamlets in accordance with the present invention. In one example, the capture module 402 (of FIG. 4) begins to capture the content file and the streamlet module 404 generates a first streamlet 303a and passes the streamlet to the encoding module 406. The encoding module 406 may take 10 seconds, for example, to generate the first set 306a of streamlets 304a (304a1, 304a2, 304a3, etc. represent streamlets 304 of

different bitrates). FIG. 5b illustrates the encoding process generically as block 502 to graphically illustrate the time duration required to process a raw or lightly encoded streamlet 303 as described above with reference to the encoding module 406. The encoding module 406 may simultaneously process more than one streamlet 303, and processing of

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streamlets will begin upon arrival of the streamlet from the capture module 402.

During the 10 seconds required to encode the first streamlet 303a, the streamlet module 404 has generated five additional 2-second streamlets 303b, 303c, 303d, 303e, 303f, for encoding and the master 502 has prepared and staged the corresponding raw streamlets. Two seconds after the first set 306a is available the next set 306b is available, and so on.  $_{15}$ As such, the content file 200 is encoded for streaming over the Internet and appears live. The 10 second delay is given herein by way of example only. Multiple hosts 504 may be added to the encoding module 406 in order to increase the processing capacity of the encoding module **406**. The delay 20 may be shortened to an almost unperceivable level by the addition of high CPU powered systems, or alternatively multiple low powered systems.

A system as described above beneficially enables multipass encoding of live events. Multi-pass encoding systems 25 of the prior art require that the entire content be captured (or be complete) because in order to perform multi-pass encoding the entire content must be scanned and processed more than once. This is impossible with prior art systems because content from a live event is not complete until the event is 30 over. As such, with prior art systems, multi-pass encoding can only be performed once the event is over. Streamlets, however, may be encoded as many times as is deemed necessary. Because the streamlet is an encapsulated media object of 2 seconds (for example), multi-pass encoding may 35 begin on a live event once the first streamlet is captured. Shortly after multi-pass encoding of the first streamlet 303a is finished, multi-pass encoding of the second streamlet 303b finishes, and as such multi-pass encoding is performed on a live event and appears live to a viewer.

Any specific encoding scheme applied to a streamlet may take longer to complete than the time duration of the streamlet itself, for example, a very high quality encoding of a 2-second streamlet may take 5 seconds to finish. Alternatively, the processing time required for each streamlet may 45 be less than the time duration of a streamlet. However, because the offset parallel encoding of successive streamlets are encoded by the encoding module at regular intervals (matching the intervals at which the those streamlets are submitted to the encoding module 406, for example 2 50 seconds) the output timing of the encoding module 406 does not fall behind the real-time submission rate of the unencoded streamlets. Conversely, prior art encoding systems rely on the very fastest computing hardware and software because the systems must generate the output immediately 55 in lock-step with the input. A prior art system that takes 2.1 seconds to encode 2 seconds worth of content is considered a failure. The present invention allows for slower than real-time encoding processes yet still achieves a real-time encoding effect due to the parallel offset pipes.

The parallel offset pipeline approach described with reference to FIG. 5b beneficially allows for long or short encoding times without "falling behind" the live event. Additionally, arbitrarily complex encoding of streamlets to multiple profiles and optimizations only lengthens the 65 encoding time 502 without a perceptible difference to a user because the sets 306 of streamlets 304 are encoded in a

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time-selective manner so that streamlets are processed at regular time intervals and transmitted at these time intervals.

Returning now to FIG. 5a, as depicted, the master 502 and the hosts 504 may be located within a single local area network, or in other terms, the hosts 504 may be in close physical proximity to the master **502**. Alternatively, the hosts 504 may receive encoding jobs from the master 502 over the Internet or other communications network. For example, consider a live sports event in a remote location where it would be difficult to setup multiple hosts. In this example, a master performs no encoding or alternatively light encoding before publishing the streamlets online. The hosts 504 would then retrieve those streamlets and encode the streamlets into the multiple bitrate sets 306 as described above.

Furthermore, hosts 504 may be dynamically added or removed from the encoding module without restarting the encoding job and/or interrupting the publishing of streamlets. If a host 504 experiences a crash or some failure, its encoding work is simply reassigned to another host.

The encoding module 406, in one embodiment, may also be configured to produce streamlets that are specific to a particular playback platform. For example, for a single raw streamlet, a single host 504 may produce streamlets for different quality levels for personal computer playback, streamlets for playback on cell phones with a different, proprietary codec, a small video-only streamlet for use when playing just a thumbnail view of the stream (like in a programming guide), and a very high quality streamlet for use in archiving.

FIG. 6a is a schematic block diagram illustrating one embodiment of a virtual timeline 600 in accordance with the present invention. In one embodiment, the virtual timeline 600 comprises at least one quantum media extension 602. The quantum media extension (hereinafter "QMX") 602 describes an entire content file 200. Therefore, the virtual timeline (hereinafter "VT") 600 may comprise a file that is configured to define a playlist for a user to view. For example, the VT may indicate that the publisher desires a user to watch a first show QMX 602a followed by QMX 602b and QMX 602c. As such, the publisher may define a broadcast schedule in a manner similar to a television station.

FIG. 6b is a schematic block diagram illustrating an alternative embodiment of a VT 600 in accordance with the present invention. In the depicted embodiment, the VT 600 may include a single QMX 602 which indicates that the publisher desires the same content to be looped over and over again. For example, the publisher may wish to broadcast a never-ending infomercial on a website.

FIG. 6c is a schematic block diagram illustrating one embodiment of a QMX 602 in accordance with the present invention. In one embodiment, the QMX 602 contains a multitude of information generated by the content module 112 configured to describe the content file 200. Examples of information include, but are not limited to, start index 604, end index 606, whether the content is live 608, proprietary publisher data 610, encryption level 612, content duration 614 and bitrate values 616. The bitrate values 616 may 60 include frame size 618, audio channel 620 information, codecs 622 used, sample rate 624, and frames parser 626.

A publisher may utilize the QVT 600 together with the QMX 602 in order to prescribe a playback order for users, or alternatively selectively edit content. For example, a publisher may indicate in the QMX 602 that audio should be muted at time index 10:42 or video should be skipped for 3 seconds at time index 18:35. As such, the publisher may

selectively skip offensive content without the processing requirements of editing the content.

FIG. 7 is a schematic block diagram graphically illustrating one embodiment of a client module 114 in accordance with the present invention. The client module 114 may 5 comprise an agent controller module 702, a streamlet cache module 704, and a network controller module 706. In one embodiment, the agent controller module 702 is configured to interface with a viewer 708, and transmit streamlets 304 to the viewer 708. Alternatively, the agent controller module 10 702 may be configured to simply reassemble streamlets into a single file for transfer to an external device such as a portable video player.

In a further embodiment, the client module **114** may comprise a plurality of agent controller modules **702**. Each 15 agent controller module **702** may be configured to interface with one viewer **708**. Alternatively, the agent controller module **702** may be configured to interface with a plurality of viewers **708**. The viewer **708** may be a media player (not shown) operating on a PC or handheld electronic device.

The agent controller module **702** is configured to select a quality level of streamlets to transmit to the viewer **708**. The agent controller module **702** requests lower or higher quality streams based upon continuous observation of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to FIG. **10**.

The agent controller module 702 may be configured to receive user commands from the viewer 708. Such commands may include play, fast forward, rewind, pause, and stop. In one embodiment, the agent controller module 702 requests streamlets 304 from the streamlet cache module 704 and arranges the received streamlets 304 in a staging module 709. The staging module 709 may be configured to arrange the streamlets 304 in order of ascending playback time. In the depicted embodiment, the streamlets 304 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 304 may be identified with a unique filename.

Additionally, the agent controller module 702 may be 40 configured to anticipate streamlet 304 requests and prerequest streamlets 304. By pre-requesting streamlets 304, the user may fast-forward, skip randomly, or rewind through the content and experience no buffering delay. In a further embodiment, the agent controller module 702 may request 45 the streamlets 304 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 702 may request streamlets at any interval less than the length of the time index. This enables a "fast-start" capability with no buffer- 50 ing wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 702 may be configured to pre-request streamlets 304 corresponding to specified index points within the content or within other content in anticipation of the end user 104 55 selecting new content to view. In one embodiment, the streamlet cache module 704 is configured to receive streamlet 304 requests from the agent controller module 702. Upon receiving a request, the streamlet cache module 704 first checks a streamlet cache 710 to verify if the streamlet 304 60 is present. In a further embodiment, the streamlet cache module 704 handles streamlet 304 requests from a plurality of agent controller modules 702. Alternatively, a streamlet cache module 704 may be provided for each agent controller module 702. If the requested streamlet 304 is not present in 65 the streamlet cache 410, the request is passed to the network controller module 706. In order to enable fast forward and

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rewind capabilities, the streamlet cache module 704 is configured to store the plurality of streamlets 304 in the streamlet cache 710 for a specified time period after the streamlet 304 has been viewed. However, once the streamlets 304 have been deleted, they may be requested again from the web server 116.

The network controller module 706 may be configured to receive streamlet requests from the streamlet cache module 704 and open a connection to the web server 116 or other remote streamlet 304 database (not shown). In one embodiment, the network controller module 706 opens a TCP/IP connection to the web server 116 and generates a standard HTTP GET request for the requested streamlet 304. Upon receiving the requested streamlet 304, the network controller module 706 passes the streamlet 304 to the streamlet cache module 704 where it is stored in the streamlet cache 710. In a further embodiment, the network controller module 706 is configured to process and request a plurality of streamlets 304 simultaneously. The network controller module 706 20 may also be configured to request a plurality of streamlets, where each streamlet 304 is subsequently requested in multiple parts.

In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 304 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates problems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 304. Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more useful and predictable timing.

In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by the client as a forward cache. By requesting more than one streamlet 304 at a time in a manner referred to as "parallel retrieval," or more than one part of a streamlet 304 at a time, efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 304 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection fail. Streamlet 304 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from falling into a slow-start or close mode. If the network controller module 706 has requested a streamlet 304 in multiple parts, with each part requested on mutually independent TCP/IP connections, the network controller module 706 reassembles the parts to present a complete streamlet 304 for use by all other components of the client module 114.

When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet **304**. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet **304**. If the first streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the redundant request response, the first request may be aborted.

Several streamlet 304 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This eliminates all but the first request latency. Because multiple responses are always being transmitted, the processing

latency of each new streamlet 304 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious vulnerabilities. Transmission delays affect all of the responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

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Multiple TCP connections may be opened between the client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while maintaining the independence of each streamlet 304 request. Several streamlet 304 requests may be sent concurrently, 15 with each request being sent on a mutually distinct TCP connection. This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 20 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does not affect the transmission of other responses because each response occupies an independent TCP connection. Any 25 transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding responses.

A single streamlet **304** request may be issued for an entire streamlet **304**, or multiple requests may be issued, each for 30 a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by the client module **114** streamlet.

In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three streamlet 304 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses diminishes the net response time of the other three responses. The 45 timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to maintain the proper balance of efficiency and response times.

The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the 50 depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof, of the illustrated method. Additionally, the format and symbols 55 employed are provided to explain the logical steps of the method and are understood not to limit the scope of the method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood not to limit the scope of the corresponding method. Indeed, 60 some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumerated steps of the depicted method. Additionally, the order in which a particular method occurs 65 may or may not strictly adhere to the order of the corresponding steps shown.

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FIG. 8 is a schematic flow chart diagram illustrating one embodiment of a method 800 for processing content in accordance with the present invention. In one embodiment the method 800 starts 802, and the content module 112 receives 804 content from the publisher 110. Receiving content 804 may comprise receiving 804 a digital copy of the content file 200, or digitizing a physical copy of the content file 200. Alternatively, receiving 804 content may comprise capturing a radio, television, cable, or satellite broadcast. Once received 804, the streamlet module 404 generates 808 a plurality of source streamlets 303 each having a fixed duration. Alternatively, the streamlets 303 may be generated with a fixed file size.

In one embodiment, generating 808 streamlets comprises dividing the content file 200 into a plurality of two second streamlets 303. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202. The encoder module 406 then encodes 810 the streamlets 303 into sets 306 of streamlets 304, in a plurality of streams 202 according to an encoding scheme. The quality may be predefined, or automatically set according to end user bandwidth, or in response to pre-designated publisher guidelines

In a further embodiment, the encoding scheme comprises a proprietary codec such as WMV9®. The encoder module 406 then stores 812 the encoded streamlets 304 in the streamlet database 408. Once stored 812, the web server 116 may then serve 814 the streamlets 304. In one embodiment, serving 814 the streamlets 304 comprises receiving streamlet requests from the client module 114, retrieving the requested streamlet 304 from the streamlet database 408, and subsequently transmitting the streamlet 304 to the client module 114. The method 800 then ends 816.

FIG. 9 is a schematic flow chart diagram illustrating one embodiment of a method 900 for viewing a plurality of streamlets in accordance with the present invention. The method 900 starts and an agent controller module 702 is provided 904 and associated with a viewer 708 and provided with a staging module 709. The agent controller module 702 then requests 906 a streamlet 304 from the streamlet cache module 704. Alternatively, the agent controller module 702 may simultaneously request 906 a plurality of streamlets 304 the streamlet cache module 704. If the streamlet is stored 908 locally in the streamlet cache 710, the streamlet cache module 704 retrieves 910 the streamlet 304 and sends the streamlet to the agent controller module 702. Upon retrieving 910 or receiving a streamlet, the agent controller module 702 makes 911 a determination of whether or not to shift to a higher or lower quality stream 202. This determination will be described below in greater detail with reference to FIG. 10.

In one embodiment, the staging module 709 then arranges 912 the streamlets 304 into the proper order, and the agent controller module 702 delivers 914 the streamlets to the viewer 708. In a further embodiment, delivering 914 streamlets 304 to the end user comprises playing video and or audio streamlets on the viewer 708. If the streamlets 304 are not stored 908 locally, the streamlet request is passed to the network controller module 706. The network controller module 706 then requests 916 the streamlet 304 from the web server 116. Once the streamlet 304 is received, the network controller module 706 passes the streamlet to the streamlet cache module 704. The streamlet cache module 704 archives 918 the streamlet. Alternatively, the streamlet cache module 704 then archives 918 the streamlet and passes the streamlet to the agent controller module 702, and the method 900 then continues from operation 910 as described above.

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Referring now to FIG. 10, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 1000 for requesting streamlets 304 within an adaptive-rate shifting content streaming environment in accordance with the present invention. The method 1000 may be used in one embodiment as the operation 911 of FIG. 9. The method 1000 starts and the agent controller module 702 receives 1004 a streamlet 304 as described above with reference to FIG. 9. The agent controller module 702 then monitors 1006 the receive time of the requested streamlet. In one embodiment, the agent controller module 702 monitors the time intervals A between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given  $\Delta$  may vary substantially from another. In order to compensate for this fluctuation, the agent controller module **702** calculates **1008** a performance ratio r across a window of n samples for 20 streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation:

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}$$

Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ratio r, the agent controller module 702 may calculate a geometric mean, or alternatively an equivalent averaging algorithm, across a window of size m, and obtain a performance factor  $\phi\colon$ 

$$\varphi_{current} = \left(\prod_{j=1}^{m} r_j\right)^{\frac{1}{m}}$$

The policy determination about whether or not to upshift 1010 playback quality begins by comparing  $\phi_{\it current}$  with a trigger threshold  $\Theta_{up}$ . If  $\phi_{current} \ge \Theta_{up}$ , then an up shift to the next higher quality stream may be considered 1016. In one 45 embodiment, the trigger threshold  $\Theta_{up}$  is determined by a combination of factors relating to the current read ahead margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 709 for presentation at the current playback time index), and 50 a minimum safety margin. In one embodiment, the minimum safety margin may be 24 seconds. The smaller the read ahead margin, the larger  $\Theta_{up}$  is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 702 is 55 able to sustain 1016 upshift quality, then the agent controller module 702 will upshift 1017 the quality and subsequently request higher quality streams. The determination of whether use of the higher quality stream is sustainable 1016 is made by comparing an estimate of the higher quality 60 stream's performance factor,  $\varphi_{higher}$ , with  $\Theta_{up}$ . If  $\varphi_{higher} \ge \Theta_{up}$  then use of the higher quality stream is considered sustainable. If the decision of whether or not the higher stream rate is sustainable 1016 is "no," the agent controller module 702 will not attempt to upshift 1017 stream quality. 65 If the end of the stream has been reached 1014, the method 1000 ends 1016.

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If the decision on whether or not to attempt upshift 1010 is "no", a decision about whether or not to downshift 1012 is made. In one embodiment, a trigger threshold  $\Theta_{down}$  is defined in a manner analogous to  $\Theta_{up}$ . If  $\varphi_{current} > \Theta_{down}$  then the stream quality may be adequate, and the agent controller module 702 does not downshift 1018 stream quality. However, if  $\varphi_{current} \le \Theta_{down}$ , the agent controller module 702 does downshift 1018 the stream quality. If the end of the stream has not been reached 1014, the agent controller module 702 begins to request and receive 1004 lower quality streamlets and the method 1000 starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced by alternative streamlet monitoring solutions.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

- 1. A system for adaptive-rate content streaming of a video 25 that is playable on one or more end user stations over the internet, the system comprising:
  - at least one storage device storing the video, wherein the video is digitally encoded at a plurality of different bitrates creating a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, the low quality stream, the medium quality stream, and the high quality stream each comprising a group of streamlets, wherein each streamlet corresponds to a portion of the video, and wherein each streamlet in each group of streamlets is encoded at a respective one of the plurality of different bitrates, and wherein each group of streamlets comprises at least first and second streamlets;
  - wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and
  - wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in each of the low quality stream, the medium quality stream, and the high quality stream, and wherein the first streamlet of the low quality stream encodes the same first portion of the video at a lower bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream.
  - 2. The system of claim 1, wherein the video is a live event video.
  - 3. The system of claim 1, wherein the video includes archived content.
  - 4. The system of claim 1, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.
  - 5. The system of claim 4, wherein the first and second durations are different.
  - **6**. The system of claim **1**, further comprising: a plurality of web servers located at different locations across the internet, each web server configured to: receive at least one streamlet request over one or more internet connections

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from a respective one of the one or more end user stations to retrieve the first streamlet, wherein the at least one streamlet request from the respective one of the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the 5 medium quality stream, and the high quality stream based upon a determination by the respective one of the one or more end user stations to select a higher or lower bitrate version of a respective one of the plurality of streams; retrieve from the at least one storage device the requested 10 first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and send the retrieved first streamlet to the respective one of the one or more end user stations over the one or more internet connections.

- 7. The system of claim 1, wherein each of the first streamlets has a first duration that is the range of 0.1 to 5 seconds.
  - 8. The system of claim 1, further comprising:
  - a first web server configured to: receive at least one 20 streamlet request over one or more internet connections from the one or more end user stations to retrieve the first streamlet storing the first portion of the video,
  - wherein the at least one streamlet request from the one or more end user stations includes a request for a currently 25 selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the video; retrieve from the storage device the requested 30 first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and send the retrieved first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality 35 stream to the requesting one of the end user stations over the one or more network connections.
- 9. The system of claim 8, wherein the first web server is further configured to: receive at least one virtual timeline request over the one or more internet connections from the 40 first streamlets has a first duration that is in the range of 0.1 one or more end user stations to retrieve a virtual timeline; and send the virtual timeline to the requesting one of the end user stations over the one or more network connections.
- 10. The system of claim 9, wherein the virtual timeline corresponds to the currently selected one of the low quality 45 stream, the medium quality stream, and the high quality stream.
- 11. The system of claim 10, wherein the virtual timeline defines a playlist for a user to view.
- 12. The system of claim 11, wherein the virtual timeline 50 comprises a file that is configured to define a playlist for a user to view.
- 13. The system of claim 12, wherein the virtual timeline comprises at least one quantum media extension (QMX).
- 14. An end user station to stream a video over a network 55 includes archived content. from a server for playback of the video, the end user station comprising:
  - a processor;
  - a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, 60 when executed, cause the processor to:
    - establish an internet connection between the end user station and the server, wherein the server is configured to access at least one of a plurality of groups of streamlets:
      - wherein the video is encoded at a plurality of different bitrates to create a plurality of streams

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including at least a low quality stream, a medium quality stream, and a high quality stream, each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded at the same respective one of the different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;

- wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and wherein the first streamlets of each of the low quality stream, the medium quality stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes the same portion of the video at a different one of the different bitrates;
- select a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams:
- place a streamlet request to the server over the internet connection for the first streamlet of the selected stream:
- receive the requested first streamlet from the server via the internet connection; and
- provide the received first streamlet for playback of the video.
- 15. The end user station of claim 14, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.
- 16. The end user station of claim 15, wherein the first and second durations are different.
- 17. The end user station of claim 14, wherein each of the to 5 seconds.
- 18. The end user station of claim 14, wherein the end user station is further configured to: request and receive a virtual timeline; and wherein one or more streamlet requests are based on the received virtual timeline.
- 19. The end user station of claim 18, wherein the virtual timeline corresponds to the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.
- 20. The end user station of claim 18, wherein the virtual timeline defines a playlist for a user to view.
- 21. The end user station of claim 14, wherein the video is a live event video.
- 22. The end user station of claim 14, wherein the video
- 23. A process executable by one or more servers to stream a video for playback by one or more end user stations, the process comprising:
  - storing, by the one or more servers, a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;

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wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes 5 the same first portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different one of the different bitrates than the first streamlet of the high quality stream and 10 the first streamlet of the medium quality stream;

receiving at least one streamlet request over an internet connection from a respective one of the one or more end user stations to retrieve the first streamlet storing the first portion of the video,

wherein the at least one streamlet request from the respective one of the one or more end user stations includes a request for a currently selected first streamlet from one of the low quality stream, the medium quality stream, and the high quality stream 20 based upon a determination by the respective one of the one or more end user stations to select a higher or lower bitrate version of the video;

retrieving from the one or more servers the requested first streamlet from the currently selected one of the low 25 quality stream, the medium quality stream, and the high quality stream; and

sending the retrieved first streamlet from the currently selected one of the low quality stream, the medium quality stream, and the high quality stream to the 30 respective one of the one of the end user stations over the internet connection.

- 24. The process of claim 23, wherein the second streamlet of each of the groups of streamlets each has the same second duration and corresponds to the same second portion of the 35 video in the low quality stream, the medium quality stream, and the high quality stream, the second streamlet of the low quality stream having the same bitrate as the first streamlet of the low quality stream.
- 25. The process of claim 23, wherein the first and second 40 durations are different.
- 26. The process of claim 23, wherein the video is a live event video.
- 27. The process of claim 23, wherein the video includes archived content.

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**28**. A process executable by a content player device to stream a video over a network from a server for playback of the video by the content player device, the process comprising:

establishing an internet connection between the content player device and the server.

wherein the server accesses a plurality of streams including a low quality stream, a medium quality stream, and a high quality stream, wherein the low quality stream, the medium quality stream, and the high quality stream each comprise a group of streamlets encoded at a respective one of a plurality of different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video; wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps; and

wherein the first streamlet of each of the groups of streamlets has the same first duration and encodes the same first portion of the video in the low quality stream, the medium quality stream, and the high quality stream, the first streamlet of the low quality stream having a different bitrate than the first streamlet of the high quality stream and the first streamlet of the medium quality stream;

selecting, by the content player device, a currently selected one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the content player device to select a higher or lower bitrate version of the video;

placing a streamlet request over one or more internet connections from the content player device to retrieve the first streamlet storing the first portion of the video; and

receiving the requested streamlet from the server via the internet connection; and rendering, by the content player device, the received streamlet for playback of the video.

- 29. The process of claim 28, wherein the video includes archived content.
- 30. The process of claim 28, wherein the video is a live event video.

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# GZJ KDKY'J

# (12) United States Patent Major et al.

## (54) APPARATUS, SYSTEM, AND METHOD FOR ADAPTIVE-RATE SHIFTING OF

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STREAMING CONTENT

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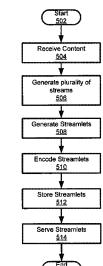
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### (57) ABSTRACT

An apparatus for adaptive-rate shifting of streaming content includes an agent controller module configured to simultaneously request at least portions of a plurality of streamlets. The agent controller module is further configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or lower quality streamlets. A staging module is configured to stage the streamlets and arrange the streamlets for playback on a content player. A system includes a data communications network, a content server coupled to the data communications network and having a content module configured to process content and generate a plurality of high and low quality streams, and the apparatus. A method includes simultaneously requesting at least portions of a plurality of streamlets, continuously monitoring streamlet requests and subsequent responses, and accordingly requesting higher or lower quality streamlets, and staging the streamlets and arranging the streamlets for playback on a content player.

### 18 Claims, 7 Drawing Sheets



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U.S. Patent

100 Client Module 114 End User Publisher <u>104</u> <u>110</u> Web Server Internet 116 <u>106</u> Web Server 116 Web Server <u>116</u> Web Server <u>116</u> Content Module <u>112</u> Web Server <u>116</u> Content Server

FIG. 1

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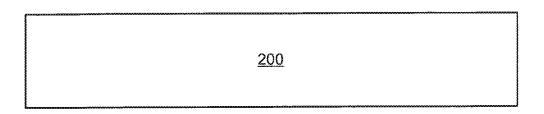


FIG. 2a

Playback Time Duration

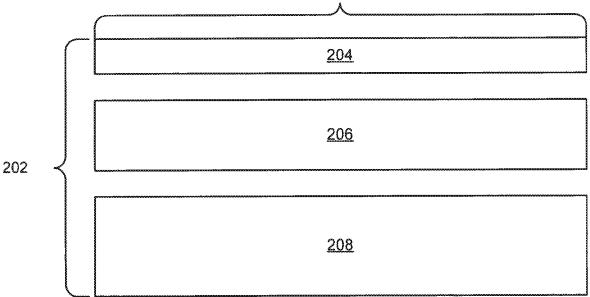


FIG. 2b

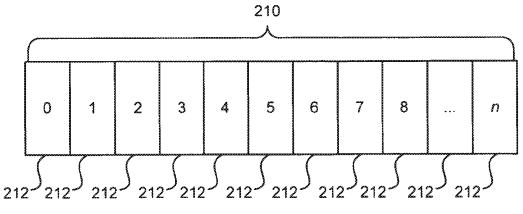
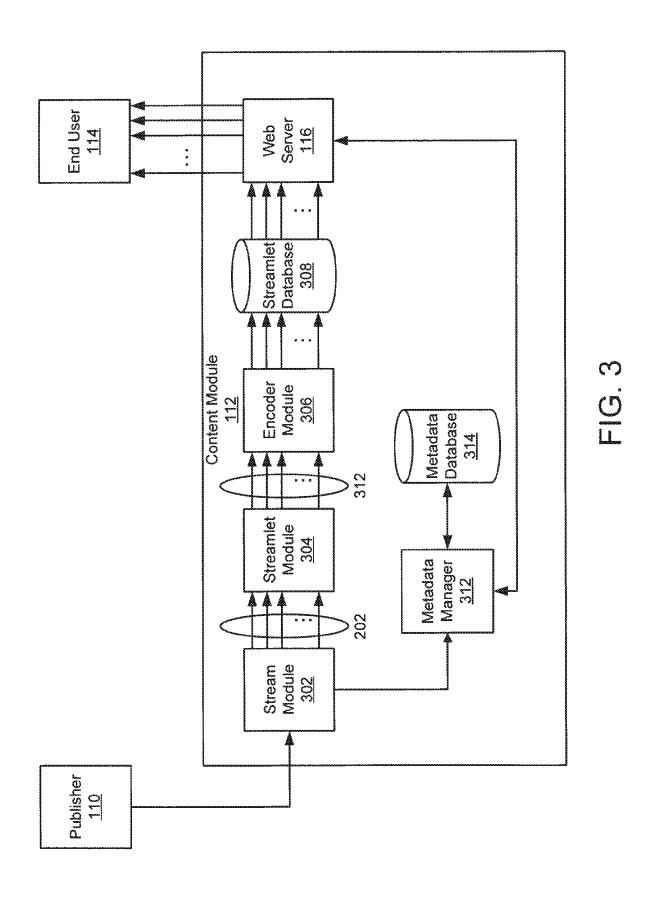


FIG. 2c

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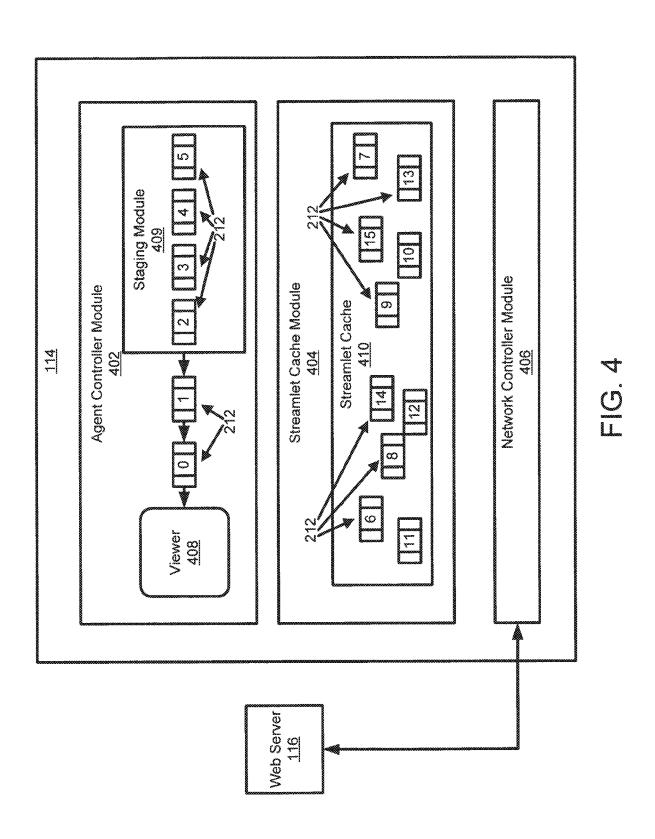
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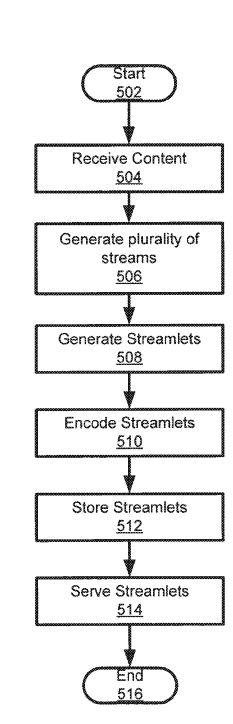


FIG. 5

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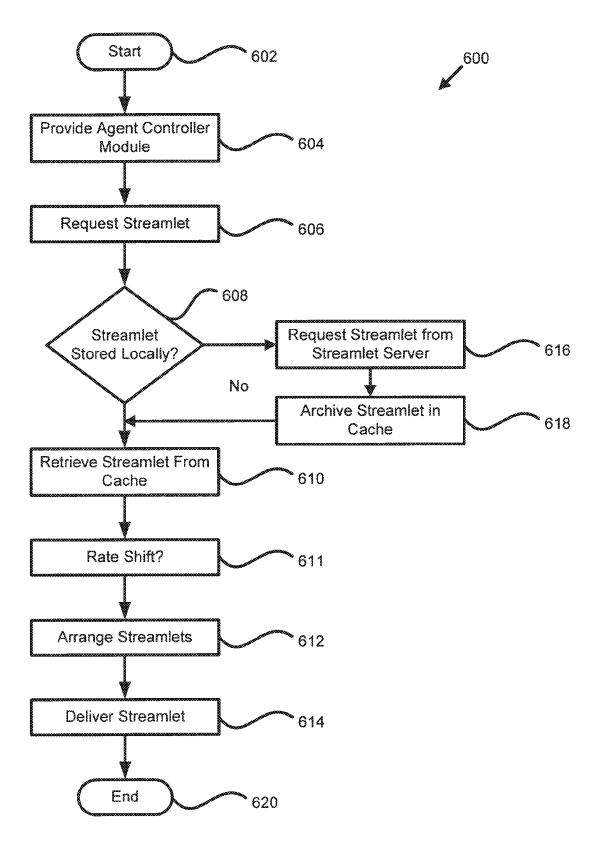
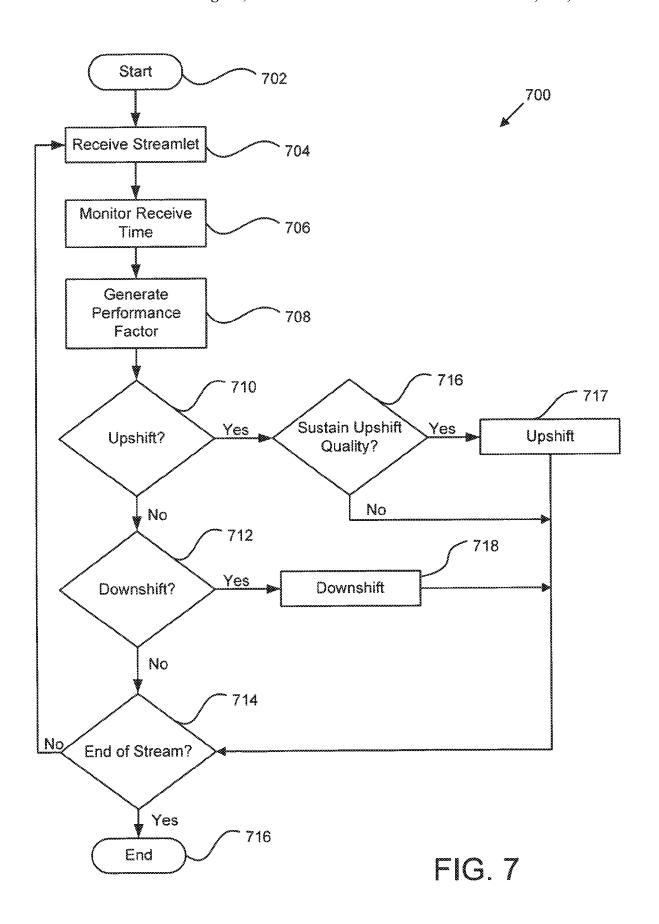


FIG. 6

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### APPARATUS, SYSTEM, AND METHOD FOR ADAPTIVE-RATE SHIFTING OF STREAMING CONTENT

### CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 15/207,172 (now U.S. Pat. No. 10,225,304), which is a continuation of U.S. patent application Ser. No. 14/516,303 (now U.S. Pat. No. 9,407,564), which is a continuation of U.S. patent application Ser. No. 11/116,783 (now U.S. Pat. No. 8,868,772), which claims benefit of United States Provisional Patent Application Ser. No. 60/566,831 entitled "APPARATUS, SYSTEM, AND 15 METHOD FOR DYNAMIC RATE SHIFTING OF STREAMING CONTENT" and filed on Apr. 30, 2004 for R. Drew Major and Mark B. Hurst, which is incorporated herein by reference.

### BACKGROUND OF THE INVENTION

### Field of the Invention

The invention relates to video streaming over packet <sup>25</sup> switched networks such as the Internet, and more particularly relates to adaptive-rate shining of streaming content over such networks.

### Description of the Related Art

The Internet is fast becoming a preferred method for distributing media files to end users. It is currently possible to download music or video to computers, cell phones, or practically any network capable device. Many portable 35 media players are equipped with network connections and enabled lo play music or videos. The music or video files (hereinafter "media files") can be stored locally on the media player or computer, or streamed or downloaded from a server

"Streaming media" refers to technology that delivers content at a rate sufficient for presenting the media to a user in real time as the data is received. The data may be stored in memory temporarily until played and then subsequently deleted. The user has the immediate satisfaction of viewing 45 the requested content without waiting for the media file to completely download. Unfortunately, the audio/video quality that can be received for real time presentation is constrained by the available bandwidth of the user's network connection. Streaming may be used to deliver content on 50 demand (previously recorded) or from live broadcasts.

Alternatively, media files may be downloaded and stored on persistent storage devices, such as hard drives or optical storage, for later presentation. Downloading complete media tiles can take large amounts of time depending on the 55 network connection. Once downloaded, however, the content can be viewed repeatedly anytime or anywhere. Media files prepared for downloading usually are encoded with a higher quality audio/video than can be delivered in real time. Users generally dislike this option, as they tend to want to 60 see or hear the media file instantaneously.

Streaming offers the advantage of immediate access to the content but currently sacrifices quality compared with downloading a file of the same content. Streaming also provides the opportunity for a user to select different content for 65 viewing on an ad hoc basis, while downloading is by definition restricted to receiving a specific content selection

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in its entirety or not at all. Downloading also supports rewind, fast forward, and direct seek operations, while streaming is unable to fully support these functions. Streaming is also vulnerable to network failures or congestion.

Another technology, known as "progressive downloads," attempts to combine the strengths of the above two technologies. When a progressive download is initiated, the media file download begins, and the media player waits to begin playback until there is enough of the file downloaded that playback can begin with the hope that the remainder of the file will be completely downloaded before playback "catches up." This waiting period before playback can be substantial depending on network conditions, and therefore is not a complete or fully acceptable solution to the problem of media presentation over a network.

Generally, three basic challenges exist with regard to data transport streaming over a network such as the Internet that has a varying amount of data loss. The first challenge is reliability. Most streaming solutions use a TCP connection, 20 or "virtual circuit," for transmitting data. A TCP connection provides a guaranteed delivery mechanism so that data sent from one endpoint will be delivered to the destination, even if portions are lost and retransmitted. A break in the continuity of a TCP connection can have serious consequences when the data must be delivered in real-time. When a network adapter detects delays or losses in a TCP connection, the adapter "backs off" from transmission attempts for a moment and then slowly resumes the original transmission pace. This behavior is an attempt to alleviate the perceived 30 congestion. Such a slowdown is detrimental to the viewing or listening experience of the user and therefore is not

The second challenge to data transport is efficiency. Efficiency refers to how well the user's available bandwidth is used for delivery of the content stream. This measure is directly related to the reliability of the TCP connection. When the TCP connection is suffering reliability problems, a loss of bandwidth utilization results. The measure of efficiency sometimes varies suddenly, and can greatly impact the viewing experience.

The third challenge is latency. Latency is the time measure form the client's point-of-view, of the interval between when a request is issued and the response data begins to arrive. This value is affected by the network connection's reliability and efficiency, and the processing time required by the origin to prepare the response. A busy or overloaded server, for example, will take more time to process a request. As well as affecting the start time of a particular request, latency has a significant impact on the network throughput of TCP.

From the foregoing discussion, it should be apparent that a need exists for an apparatus, system, and method that alleviate the problems of reliability, efficiency, and latency. Additionally, such an apparatus, system, and method would offer instantaneous viewing along with the ability to fast forward, rewind, direct seek, and browse multiple streams. Beneficially, such an apparatus, system, and method would utilize multiple connections between a source and destination, requesting varying bitrate streams depending upon network conditions.

### SUMMARY OF THE INVENTION

The present invention has been developed in response to the present state of the art, and in particular, in response to the problems and needs in the art that have not yet been fully solved by currently available content streaming systems.

Accordingly, the present invention has been developed to provide an apparatus, system, and method for adaptive-rate content streaming that overcome many or all of the abovediscussed shortcomings in the art.

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The apparatus for adaptive-rate content streaming is pro- 5 vided with a logic unit containing a plurality of modules configured to functionally execute the necessary steps. These modules in the described embodiments include an agent controller module configured to simultaneously request a plurality of streamlets, the agent controller module 10 further configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or lower quality streamlets, and a staging module configured to stage the streamlets and arrange the streamlets for playback on a content player.

The apparatus is further configured, in one embodiment, to establish multiple Transmission Control Protocol (TCP) connections with a content server, and request streamlets of varying bitrates. Each streamlet may further comprise a portion of a content file. Additionally, the agent controller 20 module may be configured to generate a performance factor according to responses from streamlet requests.

In a further embodiment, the agent controller module is configured to upshift to a higher quality streamlet when the performance factor is greater than a threshold, and the agent 25 controller module determines the higher quality playback can be sustained according to a combination of factors. The factors may include an amount of contiguously available streamlets stored in the staging module, a minimum safety margin, and a current read ahead margin.

The agent controller module may be configured to downshift to a lower quality streamlet when the performance factor is less than a second threshold. Also, the agent controller module is further configured to anticipate streamlet requests and pre-request streamlets to enable fast-for- 35 ward, skip randomly, and rewind functionality. In one embodiment, the agent controller module is configured to initially request low quality streamlets to enable instant playback of the content file, and subsequent upshifting according to the performance factor.

A system of the present invention is also presented to adaptive-rate content streaming In particular, the system, in one embodiment, includes a data communications network, and a content server coupled to the data communications network and having a content module configured to process 45 content and generate a plurality of high and low quality streams. In one embodiment, each of the high and low quality streams may include a plurality of streamlets.

In a further embodiment, the system also includes an agent controller module configured to simultaneously 50 invention briefly described above will be rendered by refrequest a plurality of streamlets, the agent controller module further configured to continuously monitor streamlet requests and subsequent responses, and accordingly request higher or lower quality streamlets, and a staging module configured to stage the streamlets and arrange the streamlets 55 tor playback on a content player.

A method of the present invention is alto presented for adaptive-rate content streaming. The method in the disclosed embodiments substantially includes the steps necessary to carry out the functions presented above with respect 60 to the operation of the described apparatus and system. In one embodiment, the method includes simultaneously requesting a plurality of streamlets, continuously monitoring streamlet requests and subsequent responses, and accordingly requesting higher or lower quality streamlets, and 65 staging the streamlets and arranging the streamlets for playback on a content player.

In a further embodiment, the method may include establishing multiple Transmission Control Protocol (TCP) connections with a content server, and requesting streamlets of varying bitrates. Also, the method may include generating a performance factor according to responses from streamlet requests, upshifting to a higher quality streamlet when the performance factor is greater than a threshold, and determining if the higher quality playback can be sustained. Furthermore, the method may include downshifting to a lower quality streamlet when the performance factor is less than a second threshold.

In one embodiment, the method includes anticipating streamlet requests and pre-requesting streamlets to enable fast-forward, skip randomly, and rewind functionality. The method may also comprise initially requesting low quality streamlets to enable instant playback of a content file, and subsequent upshifting according to the performance factor.

Reference throughout this specification to features, advantages, or similar language does not imply that all of the features and advantages that may be realized with the present invention should be or are in any single embodiment of the invention. Rather, language referring to the features and advantages is understood to mean that a specific feature, advantage, or characteristic described in connection with an embodiment is included in at least one embodiment of the present invention. Thus, discussion of the features and advantages, and similar language, throughout this specification may, but do not necessarily, refer to the same embodiment.

Furthermore, the described features, advantages, and characteristics of the invention may be combined in any suitable manner in one or more embodiments. One skilled in the relevant art will recognize that the invention may be practiced without one or more of the specific features or advantages of a particular embodiment. In other instances, additional features and advantages may be recognized in certain embodiments that may not be present in all embodi-40 ments of the invention.

These features and advantages of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

### BRIEF DESCRIPTION OF THE DRAWINGS

In order that the advantages of the invention will be readily understood, a more particular description of the erence to specific embodiments that are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings, in which:

FIG. 1 is a schematic block diagram illustrating one embodiment of a system for adaptive rate shifting of streaming content in accordance with the present invention;

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a content file in accordance with the present invention;

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams having varying degrees of quality and bandwidth in accordance with the present invention;

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FIG. 2c is a schematic block diagram illustrating one embodiment of a stream divided into a plurality of streamlets in accordance with the present invention;

FIG. 3 is a schematic block diagram illustrating one embodiment of a content module in accordance with the 5 present invention;

FIG. 4 is a schematic block diagram graphically illustrating one embodiment of a client module in accordance with the present invention.

FIG. 5 is a schematic flow chart diagram illustrating one 10 embodiment of a method for processing content in accordance with the present invention;

FIG. 6 is a schematic flow chart diagram illustrating one embodiment of a method for playback of a plurality of streamlets in accordance with the present invention; and

FIG. 7 is a schematic flow chart diagram illustrating one embodiment of a method for requesting streamlets within an adaptive-rate content streaming environment in accordance with the present invention.

### DETAILED DESCRIPTION OF THE INVENTION

Many of the functional units described in this specification have been labeled as modules, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, off-the-shelf semi conductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

Modules may also be implemented in software for execution by various types of processors. An identified module of 35 executable code may, for instance, comprise one or more physical or logical blocks of computer instructions which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may 40 comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated purpose for the module.

Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The 50 operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely as electronic signals on a system or network.

Reference throughout this specification to "one embodiment," "an embodiment," or similar language means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment," "in an embodiment," and 60 similar language throughout this specification may, but do not necessarily, all refer to the same embodiment.

Reference to a signal bearing medium may take any form capable of generating a signal, causing a signal to be generated, or causing execution of a program of machine-65 readable instructions on a digital processing apparatus. A signal bearing medium may be embodied by a transmission

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line, a compact disk, digital-video disk, a magnetic tape, a Bernoulli drive, a magnetic disk, a punch card, flash memory, integrated circuits, or other digital processing apparatus memory device.

Furthermore, the described features, structures, or characteristics of the invention may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of programming, software modules, user selections, network transactions, database queries, database structures, hardware modules, hardware circuits, hardware chips, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention may be practiced without one or more of the specific details, or with other methods, components, materials, and so forth. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

FIG. 1 is a schematic block diagram illustrating one embodiment of a system 100 for dynamic rate shifting of streaming content in accordance with the present invention. In one embodiment, the system 100 comprises a content server 102 and an end user 104. The content server 102 and the end user station 104 may be coupled by a data communications network. The data communications network may include the Internet 106 and connections 108 to the Internet 106. Alternatively, the content server 102 and the end user 104 may be located on a common local area network, wireless area network, cellular network, virtual local area network, or the like. The end user station 104 may comprise a personal computer (PC), an entertainment system configured to communicate over a network, or a portable electronic device configured lo present content.

In the depicted embodiment, the system 100 also includes a publisher 110, and a web server 116. The publisher 110 may be a creator or distributor of content. For example, if the content lobe streamed were a broadcast of a television program, the publisher 110 may be a television or cable network channel such as NBC®, or MTV®. Content may be transferred over the Internet 106 to the content server 102, where the content is received by a content module 112. The content module 112 may be configured to receive, process, and store content. In one embodiment, processed content is accessed by a client module 114 configured to play the content on the end user station 104. In a further embodiment, the client module 114 is configured to receive different portions of a content stream from a plurality of legations simultaneously. For example, the client module 114 may request and receive content from any of the plurality of web servers 116.

FIG. 2a is a schematic block diagram graphically illustrating one embodiment of a content file 200. In one embodiment, the content file 200 is distributed by the publisher 110. The content file 200 may comprise a television broadcast, sports event, movie, music, concert, etc. The content file 200 may also be live or archived content. The content file 200 may comprise uncompressed video and audio, or alternatively, video or audio. Additionally, the content file 200 may be compressed. Examples of a compressed content file 200 include, but are not limited to, DivX, Windows Media Video 9, Quicktime 6.5 Sorenson 3, or Quicktime 6.5/ MPEG-4, encoded content.

FIG. 2b is a schematic block diagram illustrating one embodiment of a plurality of streams 202 having varying degrees of quality and bandwidth. In one embodiment, the plurality of streams 202 comprises a low quality stream 204,

a medium quality stream 206, and a high quality stream 208. Each of the streams 204, 206, 208 is a copy of the content file 200 encoded and compressed to varying bit rates. For example, the low quality stream 204 may be encoded and compressed to a bit rate of 100 kilobits per second (kbps), 5 the medium quality stream 206 may be encoded and compressed to a bit rate of 200 kbps, and the high quality stream 208 may be encoded and compressed to 600 kbps.

FIG. 2c is a schematic block diagram illustrating one embodiment of a stream 210 divided into a plurality of 10 streamlets 212. As used herein, streamlet refers to any sized portion of the content file 200. Each streamlet 212 may comprise a portion of the content contained in stream 110, encapsulated as an independent media object. The content in a streamlet 212 may have a unique time index in relation to 15 the beginning of the content contained in stream 210. In one embodiment, the content contained in each streamlet 212 has a duration of two seconds. For example, streamlet 0 may have a time index of 00:00 representing the beginning of content playback, and streamlet 1 may have a time index of 20 00:02, and so on. Alternatively, the time duration of the streamlets 212 may be any duration smaller than the entire playback duration of the content in stream 210. In a further embodiment, the streamlets 212 may be divided according to file size instead of a time index.

FIG. 3 is a schematic block diagram illustrating in greater detail one embodiment of the content module 112 in accordance with the present invention. The content module 304, an encoder module 306, a streamlet database 308, and the 30 web server 116. In one embodiment, the stream module 302 is configured to receive the content file 200 from the publisher 110 and generate the plurality of streams 202 of varying qualities. The original content file 200 from the publisher may be digital in form and may comprise content 35 having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher 110 to the content module 112 over the Internet 106. Such transfers of data are well known in the art and do not require further discussion herein. Alternatively, the content may comprise a 40 captured broadcast.

In the depicted embodiment, the plurality of streams 202 may comprise the low quality stream 204, the medium quality stream 206, and the high quality stream 208. Alternatively, the plurality of streams 202 may comprise any 45 number of streams deemed necessary to accommodate end user bandwidth. The streamlet module 304 may be configured to receive the plurality of streams 202 from the stream module and generate a plurality of streams 312, each stream comprising a plurality of streamlets 212. As described with 50 reference to FIG. 2c, each streamlet 212 may comprise a pre-defined portion of the stream. The encoder module 306 is configured to encode each streamlet from the plurality of streams 312 and store the streamlets in the streamlet database 308 The encoding module 306 may utilize encoding 55 schemes such as DivX®, Windows Media Video 9®, Quicktime 6.5 Sorenson 3®, or Quicktime 6.5/MPEG-4®. Alternatively, a custom encoding scheme may be employed.

The content module 112 may also include a metadata module 312 and a metadata database 314. In one embodiment, metadata comprises static searchable content information. For example, metadata includes, but is not limited to, air date of the content, title, actresses, actors, length, and episode name. Metadata is generated by the publisher 110, and may be configured to define an end user environment. In one embodiment, the publisher 100 may define an end user navigational environment for the content including menus,

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thumbnails, sidebars, advertising, etc. Additionally, the publisher 110 may define functions such as fast forward, rewind, pause, sad play that may be used with the content file 200. The metadata module 312 is configured to receive the metadata from the publisher 110 and store the metadata in the metadata database 314. In a further embodiment, the metadata module 312 is configured to interface with the client module 114, allowing the client module 114 to search for content based upon at least one of a plurality of metadata criteria. Additionally, metadata may be generated by the content module 112 through automated processes or manual definition.

Once the streamlets 212 have been received and processed, the client module 114 may request streamlets 212 using HTTP from the web server 116. Such use of client side initiated requests requires no additional configuration of firewalls. Additionally, since the client module 114 initiates the request, the web server 116 is only required to retrieve and serve the requested streamlet. In a further embodiment, the client module 114 may be configured to retrieve streamlets 212 from a plurality of web servers 310. Each web server 116 may be located in various locations across the Internet 106. The streamlets 212 are essentially static files. As such, no specialized media server or server-side intelligence is required for a client module 114 to retrieve streamlets 212. Streamlets 212 may be served by the web server 116 or cached by cache servers of Internet Service Providers (ISPs), or any ether network infrastructure operators, and served by the cache server. Use of cache servers is well known to those skilled in the art, and will not be discussed further herein. Thus, a highly scalable solution is provided that is not hindered by massive amounts of client module 114 requests to the web server 116 at any specific location.

varying qualities. The original content file **200** from the publisher may be digital in form and may comprise content having a high bit rate such as, for example, 2 mbps. The content may be transferred from the publisher **110** to the content module **112** over the Internet **106**. Such transfers of data are well known in the art and do not require further discussion herein. Alternatively, the content may comprise a captured broadcast.

In the depicted embodiment, the plurality of streams **202** may comprise any comprise the low quality stream **204**, the medium quality stream **206**, and the high quality stream **208**. Alternatively, the plurality of streams **202** may comprise any to accommodate end user bandwidth. The streamlet module **304** may be configured to receive the plurality of streams **202** from the stream

The agent controller module 402 is configured to select a quality level of streamlets to transmit to the viewer 408 The agent controller module 402 requests lower or higher quality streams based upon continuous observation of time intervals between successive receive times of each requested streamlet. The method of requesting higher or lower quality streams will be discussed in greater detail below with reference to FIG. 7.

The agent controller module 402 may be configured to receive user commands from the viewer 408. Such commands may include play, fast forward, rewind, pause, and stop. In one embodiment, the agent controller module 402 requests streamlets 212 from the streamlet cache module 404 and arranges the received streamlets 212 in a staging module 409. The staging module 409 may be configured to arrange the streamlets 212 in order of ascending playback time. In the depicted embodiment, the streamlets 212 are numbered 0, 1, 2, 3, 4, etc. However, each streamlet 212 may be identified with a unique filename.

Additionally, the agent controller module 402 may be configured to anticipate streamlet 212 requests and prerequest streamlets 212. By pre-requesting streamlets 212, the user may fast-forward, skip randomly, or rewind through the content and experience no buffering delay. In a further 5 embodiment, the agent controller module 402 may request the streamlets 212 that correspond to time index intervals of 30 seconds within the total play time of the content. Alternatively, the agent controller module 402 may request streamlets at any interval less than the length of the time 10 index. This enables a "fast-start" capability with no buffering wait when starting or fast-forwarding through content file 200. In a further embodiment, the agent controller module 402 may be configured to pre-request streamlets 212 corresponding to specified index points within the content or 15 within other content in anticipation of the end user 104

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In one embodiment, the streamlet cache module 404 is configured to receive streamlet 212 requests from the agent controller module **402**. Upon receiving a request, the stream- 20 let cache module 404 first checks a streamlet cache 410 to verify if the streamlet 212 is present. In a further embodiment, the streamlet cache module 404 handles streamlet 212 requests from a plurality of agent controller modules 402. Alternatively, a streamlet cache module 404 may be pro- 25 vided for each agent controller module 402. If the requested streamlet 212 is not present in the streamlet cache 410 the request is passed to the network controller module 406. In order to enable fast forward and rewind capabilities, the streamlet cache module 404 is configured to store the 30 plurality of streamlets 212 in the streamlet cache 410 for a specified time period after the streamlet 212 has been viewed. However, once the streamlets 212 have been deleted, they maybe requested again from the web server

selecting new content to view.

The network controller module 406 may be configured to receive streamlet requests from the streamlet cache module 404 and open a connection to the web server 116 or other remote streamlet 212 database (not shown). In one embodiconnection to the web server 116 and generates a standard HTTP GET request for the requested streamlet 212. Upon receiving the requested streamlet 212, the network controller module 406 passes the streamlet 212 to the streamlet cache module 404 where it is stored in the streamlet cache 410. In 45 a further embodiment, the network controller module 406 is configured to process and request a plurality of streamlets 212 simultaneously. The network controller module 406 may also be configured to request a plurality of streamlets, where each streamlet 212 is subsequently requested in 50 multiple parts.

In a further embodiment, streamlet requests may comprise requesting pieces of any streamlet file. Splitting the streamlet 212 into smaller pieces or portions beneficially allows for an increased efficiency potential, and also eliminates prob- 55 lems associated with multiple full-streamlet requests sharing the bandwidth at any given moment. This is achieved by using parallel TCP/IP connections for pieces of the streamlets 212. Consequently, efficiency and network loss problems are overcome, and the streamlets arrive with more 60 useful and predictable timing.

In one embodiment, the client module 114 is configured to use multiple TCP connections between the client module 114 and the web server 116 or web cache. The intervention of a cache may be transparent to the client or configured by 65 the client as a forward cache. By requesting more than one streamlet 212 at a time in a manner referred to as "parallel

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retrieval," or more than one pan of a streamlet 212 at a time, efficiency is raised significantly and latency is virtually eliminated. In a further embodiment, the client module allows a maximum of three outstanding streamlet 212 requests. The client module 114 may maintain additional open TCP connections as spares to be available should another connection fail. Streamlet 212 requests are rotated among all open connections to keep the TCP flow logic for any particular connection from failing into a slow-start or close mode, if the network controller module 406 has requested a streamlet 212 in multiple parts, with each part requested on mutually independent TCP/IP connections, the network controller module 406 reassembles the parts to present a complete streamlet 212 for use by all other components of the client module 114.

When a TCP connection fails completely, a new request may be sent on a different connection for the same streamlet 212. In a further embodiment, if a request is not being satisfied in a timely manner, a redundant request may be sent on a different connection for the same streamlet 212. If the first streamlet request's response arrives before the redundant request response, the redundant request can be aborted. If the redundant request response arrives before the first request response, the first request may be aborted.

Several streamlet 212 requests may be sent on a single TCP connection, and the responses are caused to flow back in matching order along the same connection. This eliminates all but the first request latency. Because multiple responses are always being transmitted, the processing latency of each new streamlet 212 response after the first is not a factor in performance. This technique is known in the industry as "pipelining." Pipelining offers efficiency in request-response processing by eliminating most of the effects of request latency. However, pipelining has serious vulnerabilities. Transmission delays affect all of the responses. If the single TCP connection fails, all of the outstanding requests and responses are lost. Pipelining causes a serial dependency between the requests.

Multiple TCP connections may be opened between the ment, the network controller module 406 opens a TCP/IP 40 client module 114 and the web server 116 to achieve the latency-reduction efficiency benefits of pipelining while maintaining the independence of each streamlet 212 request. Several streamlet 212 requests may be sent concurrently, with each request being sent on a mutually distinct TCP connection This technique is labeled "virtual pipelining" and is an innovation of the present invention. Multiple responses may be in transit concurrently, assuring that communication bandwidth between the client module 114 and the web server 116 is always being utilized. Virtual pipelining eliminates the vulnerabilities of traditional pipelining. A delay in or complete failure of one response does not affect the transmission of other responses because each response occupies an independent TCP connection. Any transmission bandwidth not in use by one of multiple responses (whether due to delays or TCP connection failure) may be utilized by other outstanding responses.

> A single streamlet 212 request may be issued for an entire streamlet 212, or multiple requests may be issued, each for a different part or portion of the streamlet. If the streamlet is requested in several parts, the parts may be recombined by the client module 114 streamlet.

In order to maintain a proper balance between maximized bandwidth utilization and response time, the issuance of new streamlet requests must be timed such that the web server 116 does not transmit the response before the client module 114 has fully received a response to one of the previously outstanding streamlet requests. For example, if three stream11

let 212 requests are outstanding, the client module 114 should issue the next request slightly before one of the three responses is fully received and "out of the pipe." In other words, request timing is adjusted to keep three responses in transit. Sharing of bandwidth among four responses dimin- 5 ishes the net response time of the other three responses. The timing adjustment may be calculated dynamically by observation, and the request timing adjusted accordingly to maintain the proper balance of efficiency and response times.

The schematic flow chart diagrams that follow are generally set forth as logical flow chart diagrams. As such, the depicted order and labeled steps are indicative of one embodiment of the presented method. Other steps and methods may be conceived that are equivalent in function, logic, or effect to one or more steps, or portions thereof, of 15 the illustrated method. Additionally, the format and symbols employed are provided to explain the logical steps of the method and are understood not to limit the scope of the method. Although various arrow types and line types may be employed in the flow chart diagrams, they are understood 20 not to limit the scope of the corresponding method. Indeed, some arrows or other connectors may be used to indicate only the logical flow of the method. For instance, an arrow may indicate a waiting or monitoring period of unspecified duration between enumerated steps of the depicted method. 25 Additionally, the order in which a particular method occurs may or may not strictly adhere to the order of the corresponding steps shown.

FIG. 5 is a schematic (low chart diagram illustrating one embodiment of a method 500 for processing content in 30 accordance with the present invention. In one embodiment the method 500 starts 502, and the content module 112 receives 504 content from the publisher 110. Receiving content 504 may comprise receiving 504 a digital copy of the content file 200, or digitizing a physical copy of the 35 content file 200. Alternatively, receiving 504 content may comprise capturing a radio or television broadcast. Once received 504, the stream module 302 generates 506 a plurality of streams 202, each stream 202 having a different quality. The quality may be predefined, or automatically set 40 according to end user bandwidth, or in response to predesignated publisher guidelines.

The streamlet module 304 receives the streams 202 and generates 508 a plurality of streamlets 212. In one embodiment, generating 508 streamlets comprises dividing the 45 stream 202 into a plurality of two second streamlets 212. Alternatively, the streamlets may have any length less than or equal to the length of the stream 202 The encoder module 306 then encodes 510 the streamlets according to a compression algorithm. In a further embodiment, the algorithm 50 comprises a proprietary codec such as WMV9®. The encoder module 306 then stores 512 the encoded streamlets in the streamlet database 308. Once stored 512, the web server 116 may then serve 514 the streamlets. In one embodiment, serving 514 the streamlets comprises receiving 55 streamlet requests from the client module 114, retrieving the requested streamlet from the streamlet database 308, and subsequently transmitting the streamlet to the client module 114. The method 500 then ends 516.

FIG. 6 is a schematic flow chart diagram illustrating one 60 mance factor φ: embodiment of a method 600 for viewing a plurality of streamlets in accordance with the present invention. The method 600 starts and an agent control module 402 is provided 604 and associated with a viewer 408 and provided with a staging module 409. The agent controller module 402 65 then requests 606 a streamlet from the streamlet cache module 404. Alternatively, the agent controller module 402

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may simultaneously request 606 a plurality of streamlets from the streamlet cache module 404. If the streamlet is stored 608 locally in the streamlet cache 410, the streamlet cache module 404 retrieves 610 the streamlet and sends the streamlet to the agent controller module 402. Upon retrieving 610 or receiving a streamlet, the agent controller module 402 makes 611 a determination of whether or not to shift to a higher or lower quality stream 202. This determination will be described below in greater detail with reference to FIG.

In one embodiment, the staging module 409 then arranges 612 the streamlets into the proper order, and the agent controller module 402 delivers 614 the streamlets to the viewer 408. In a further embodiment, delivering 614 streamlets to the end user comprises playing video and or audio streamlets on the viewer 408. If the streamlets are not stored **608** locally, the streamlet request is passed to the network controller module 406. The network controller module 406 then requests 616 the streamlet from the web server 116. Once the streamlet is received, the network controller module 406 passes the streamlet to the streamlet cache module 404 The streamlet cache module 404 archives 618 the streamlet. Alternatively, the streamlet cache module 404 then archives 618 the streamlet and passes the streamlet to the agent controller module 402, and the method 600 then continues from operation 610 as described above.

Referring now to FIG. 7, shown therein is a schematic flow chart diagram illustrating one embodiment of a method 700 for requesting streamlets within a adaptive-rate shifting content streaming environment in accordance with the present invention. The method 700 may be used in one embodiment as the operation 611 of FIG. 6. The method 700 starts and the agent controller module 402 receives 704 a streamlet as described above with reference to FIG. 6. The agent controller module 402 then monitors 706 the receive time of the requested streamlet. In one embodiment, the agent controller module 402 monitors the time intervals  $\Delta$  between successive receive times for each streamlet response. Ordering of the responses in relation to the order of their corresponding requests is not relevant.

Because network behavioral characteristics fluctuate, sometimes quite suddenly, any given  $\Delta$  may vary substantially from another. In order to compensate for this fluctuation, the agent controller module 402 calculates 708 a performance ratio r across a window of n samples for streamlets of playback length S. In one embodiment, the performance ratio r is calculated using the equation

$$r = S \frac{n}{\sum_{i=1}^{n} \Delta_i}.$$

Due to multiple simultaneous streamlet processing, and in order to better judge the central tendency of the performance ration r, the agent control module 402 may calculate a geometric mean, or alternatively an equivalent averaging algorithm, across a window of size m, and obtain a perfor-

$$\varphi_{current} = \left( \prod_{j=1}^{m} r_j \right)^{\frac{1}{m}}.$$

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The policy determination about whether or not to upshift 710 playback quality begins by comparing  $\phi_{\it current}$  with a trigger threshold  $\Theta_{up}$ . If  $\phi_{current} \ge \Theta_{up}$ , then an up shift to the next higher quality stream may be considered 716. In one embodiment, the trigger threshold  $\Theta_{up}$  is determined by a 5 combination of factors relating to the current read ahead margin (i.e. the amount of contiguously available streamlets that have been sequentially arranged by the staging module 409 for presentation at the current playback time index), and a minimum safety margin. In one embodiment, the minimum safety margin may be 24 seconds. The smaller the read ahead margin, the larger  $\Theta_{up}$  is to discourage upshifting until a larger read ahead margin may be established to withstand network disruptions. If the agent controller module 402 is able to sustain 716 upshift quality, then the agent controller module 402 will upshift 717 the quality and subsequently request higher quality streams. The determination of whether use of the higher quality stream is sustainable 716 is made by comparing an estimate of the higher quality 20 stream's performance factor,  $\varphi_{higher}$ , with  $\Theta_{up}$ . If  $\varphi_{higher} \ge \Theta_{up}$  then use of the higher quality stream is considered sustainable. If the decision of whether or not the higher stream rate is sustainable 716 is "no," the agent control module 402 will not attempt to upshift 717 stream quality. 25 If the end of the stream has been reached 714, the method 618 ends 716.

If the decision on whether or not to attempt upshift 710 is "no", a decision about whether or not to downshift 712 is made. In one embodiment, a trigger threshold  $\Theta_{down}$  is 30 defined in a manner analogous to  $\Theta_{up}$ . If  $\varphi_{currenn} > \Theta_{down}$  then the stream quality may be adequate, and the agent controller module 402 does not downshift 718 stream quality. However, if  $\varphi_{currenn} \leq \Theta_{down}$ , the agent controller module 402 does downshift 718 the stream quality. If the end of the stream has 35 not been reached 714, the agent controller module 402 begins to request and receive 704 lower quality streamlets and the method 618 starts again. Of course, the above described equations and algorithms are illustrative only, and may be replaced by alternative streamlet monitoring solutions.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

- 1. An apparatus for rendering a video that is adaptively received as a digital stream from a video server over a network, the apparatus comprising;
  - a media player operating on the apparatus, wherein the 55 media player is configured to stream the video from the video server via at least one transmission control protocol (TCP) connection over the network, wherein the video server stores multiple different copies of the video encoded at different bit rates as multiple sets of 60 streamlets, wherein each of the streamlets yields a different portion of the video on playback, wherein the streamlets across the different copies yield the same portions of the video on playback, and wherein the streamlets in the different copies are aligned in time 65 such that the streamlets that play back the same portion of the video for the different copies each begin at the

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same playback time in relation to the beginning of the video, and wherein the media player streams the video by:

requesting sequential streamlets of one of the copies from the video server according to the playback times of the streamlets by transmitting hypertext transport protocol (HTTP) GET requests that identify the selected streamlets stored by the video server, wherein the sequential streamlets are selected by the media player from the based upon successive determinations to shift the playback quality to a higher or lower quality one of the different copies of the video;

repeatedly generating, by the media player, a factor relating to the performance of the network that is indicative of an ability to sustain the streaming of the video;

- adapting the successive determinations to shift the playback quality based on the factor to achieve continuous playback of the video using the streamlets of the highest quality copy of the video that is determined to be sustainable at that time; and
- presenting the video for playback by providing the requested streamlets in order of ascending start time.
- 2. The apparatus of claim 1, wherein the apparatus is configured to establish multiple Transmission Control Protocol (TCP) connections with a content server, and request streamlets of varying bitrates.
- **3**. The apparatus of claim **1**, wherein each streamlet further comprises a portion of a content file provided by the server.
- **4.** The apparatus of claim **1**, wherein the requesting the sequential streamlets comprises the apparatus transmitting hypertext transport protocol (HTTP) GET requests for selected streamlets, wherein each of the HTTP GET requests identifies the separate file stored by the video server that corresponds to the requested streamlet.
- **5**. The apparatus of claim **1** wherein each of the streamlets of each of the different copies is independently requestable and playable by the apparatus.
- **6**. The apparatus of claim **4**, wherein the requesting of the sequential streamlets comprises the end user device transmitting hypertext transport protocol (HTTP) GET requests for selected streamlets.
- 7. The apparatus of claim 1 wherein each of the streamlets in each of the plurality of different copies is a separate file stored by the video server.
- 8. The apparatus of claim 1 wherein the media player upshifts to a higher quality one of the different copies when the factor is greater than a first threshold and downshifts to a lower quality one of the different copies when the factor is less than a second threshold.
  - 9. The apparatus of claim 1, wherein the requesting the sequential streamlets comprises the apparatus transmitting hypertext transport protocol (HTTP) GET requests for selected streamlets, and wherein each of the HTTP GET requests identifies a separately-identifiable portion of the one or more files that corresponds to the requested streamlet.
  - 10. The apparatus of claim 1, wherein the apparatus is configured to initially request low quality streamlets to enable instant playback of the content file, and subsequent upshifting according to the performance factor.
  - 11. The end user device of claim 1 wherein each of the streamlets in each of the plurality of different copies is a separately-identifiable portion of one or more files stored by the video server.
  - **12**. The apparatus of claim **1** wherein the apparatus is a mobile computing device comprising a processor and a non-transitory data storage.

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13. A method executable by an end user device to stream a video received via a connection with a server over a network, the method comprising:

requesting, by the end user device, wherein the end user device streams the video from the video server via at 5 least one transmission control protocol (TCP) connection over the network, a plurality of sequential streamlets of one of the copies from the server based on playback times of the streamlets wherein multiple different copies of the video encoded at different bit rates are stored as multiple sets of streamlets on the server, wherein each of the streamlets yields a different portion of the video on playback, wherein the streamlets across the different copies yield the same portions of the video on playback, and wherein each of the streamlets comprises a playback time such that each of the streamlets for each of the different copies that encode the same portion of the video begins at the same playback time in relation to the beginning of the video, 20 wherein the end user device requests the streamlets by transmitting hypertext transport protocol (HTTP) GET requests that each identify one of the requested streamlets stored by the server; and wherein the end user device streams the video by:

repeatedly generating, by the end user device, a factor that is indicative of an ability to sustain the streaming of the video;

making successive determinations by the end user device to shift the playback quality based on the factor to 16

achieve continuous playback of the video using the streamlets of the highest quality copy determined sustainable at that time; and

presenting the video by playing back the requested media streamlets on the end user device in order of ascending playback time.

14. The method of claim 13 wherein the making of the successive determinations to shift comprises upshifting to a higher quality one of the different copies when the at least one factor is greater than a first threshold and downshifting to a lower quality one of the different copies when the at least one factor is less than a second threshold.

15. The method of claim 14 wherein each of the streamlets of each of the different copies is independently requestable and playable by the end user device.

16. The method of claim 13 wherein each of the streamlets in each of the plurality of different copies is a separately-identifiable portion of one or more files stored by the video server.

17. The method of claim 16 wherein the requesting of the sequential streamlets comprises the end user device transmitting hypertext transport protocol (HTTP) GET requests for selected streamlets, and wherein each of the HTTP GET requests identifies the separately-identifiable portion of the one or more files that corresponds to the requested streamlet.

18. The method of claim 13, wherein the video captures a live event, and wherein the streamlets of the different copies are available to the end user device while the live event is occurring.

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# **EXHIBIT I**

# The Safe Streaming™ Platform for Kids

Shows your family wants, hand-picked by caring people. Safe & free.

WATCH FREE NOW!

or **sign up here** for additional features including customized profiles, full parental controls, and viewing history.

## A safe place for your kid.

Kidoodle.TV® is a Safe Streaming™ platform with content hand-picked by parents like you. Join our family and find peace-of-mind knowing your kids are safe.





# Curated Content

No fancy algorithms here. Every show available on our service has been watched and screened by a real human being.



# Parental Controls

Be the best parent,
even when you're not
there. **Bedtimes**,
curfews, analytics,
and more features
are available to all
users.



### Easy-to-Watch

Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.

# Your family is safe here.

Kidoodle.TV is a Safe Streaming<sup>™</sup> platform with content hand-picked by parents like you. Join our family and find peace-of-mind knowing your kids are safe.

WATCH FREE NOW!



# Completely free, watch instantly.

WATCH FREE NOW!





# Stream on any popular device!

Kidoodle.TV is accessible on over 1000 devices including iOS devices, Android devices, MACs, PCs, and streaming media boxes such as Roku, Apple TV, and Fire TV.























fetch

# Start watching now!

Get Kidoodle.TV on your device of choice. Download the app and start watching for free today!









### Click to learn more!

Social Impact is an initiative of A Parent Media Co. Inc.

# "' GZJ KDKY'L



Englewood, CO 80155-6663

Joseph F. Edell Corporate Counsel, IP Direct Dial 202.463.3719 joseph.edell@dish.com

March 17, 2023

Via e-mail: mike@kidoodle.tv, team@kidoodle.tv

Michael Lowe Chief Executive Officer A Parent Media Co. Inc. 333 24th Ave SW, Suite 320 Calgary, Alberta T2S 3E6 Canada

Re: Licensing Opportunity, U.S. Patent No. 10,757,156 et al.

Dear Mr. Lowe:

DISH owns a portfolio of patent assets directed to adjustable bit-rate video streaming technology. For example, U.S. Patent No. 10,757,156 (copy enclosed) claims apparatuses and methods for transmitting video content by providing a content player access to multiple copies of the same video divided into segments, with each differing copy of the video encoded at differing bit rates. The content player obtains segments from the multiple copies to playback the entire video. This technology is used at least in adaptive bit-rate streaming standards, such as HTTP Live Streaming ("HLS") and MPEG-DASH.

DISH has analyzed the streaming technology that A Parent Media Co. ("APMC") uses for providing content to its customers. This technology appears to be covered by, for example, claim 1 of the '156 Patent. For those reasons, it appears that APMC would benefit from a license to the '156 Patent and other DISH patents in this portfolio, including the enclosed list of U.S. and international patents and patent applications.

On September 9, 2022, the Chief Judge of the International Trade Commission issued a decision finding that products being imported into the U.S. are infringing the '156 Patent and other patents in this portfolio. Upon review of that decision, on March 8, 2023, the Commission determined that the appropriate form of relief is to issue a limited exclusion order and cease and desist orders against iFit (NordicTrack) and Peloton. We encourage you to review those materials, which are enclosed, because the Commission found that products using HLS and/or MPEG-DASH infringe certain claims of those patents. Further, the Commission found that those





claims are not invalid or unenforceable on anticipation, obviousness, ineligible subject matter, indefiniteness, inventorship, or inequitable conduct grounds.

We invite APMC to take a license to this portfolio. After you have a chance to review the enclosed materials, please contact me to discuss the possibility of a license. We are open to entering into an NDA to discuss this proposal. We look forward to hearing from you.

Sincerely.

Joseph Edell

Enc.

# EXHIBIT K

This message originated outside of DISH and was sent by: don@young-law.ca

1

Mr. Edell, I am the Director Legal at APMC. My understanding is we are not currently using ABR technology. That said, we are always interested in proposals that might enhance the effectiveness of our streaming services. What is the rate proposal you are offering and its terms?

### Don Young, K.C.

(403) 589-7337

2400, 333-7th Ave SW, Calgary, AB T2P 2Z1

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# " GZJ KDKY'N

### Bigler, Susan

From: Don Young, K.C. <don@young-law.ca>

**Sent:** Monday, July 24, 2023 6:52 PM

**To:** Joe Edell **Subject:** DISH license

This message originated outside of DISH and was sent by: don@young-law.ca

Mr. Edell, while we appreciate you contacting us with the license offer and rate, it is not of interest to APMC at the moment. Should that change, we will certainly reach out to you.

### Don Young, K.C.

(403) 589-7337 2400, 333-7<sup>th</sup> Ave SW, Calgary, AB T2P 2Z1

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# **EXHIBIT M**

### **U.S. Patent No. 10,469,554 to Kidoodle**

The following claim chart shows exemplary aspects of A Parent Media Co. Inc.'s Kidoodle.TV streaming services and products ("Kidoodle") that infringe claim 1 of the '554 Patent. The chart is exemplary and should not be read to limit DISH's assertions against Kidoodle, or any other streaming services offered by A Parent Media Co. Inc. or Kidoodle as to the services or products described below. The chart should not be read to limit DISH's assertions to the patent claim charted below. Nor should the chart below be read to limit how Kidoodle infringes the claim below.

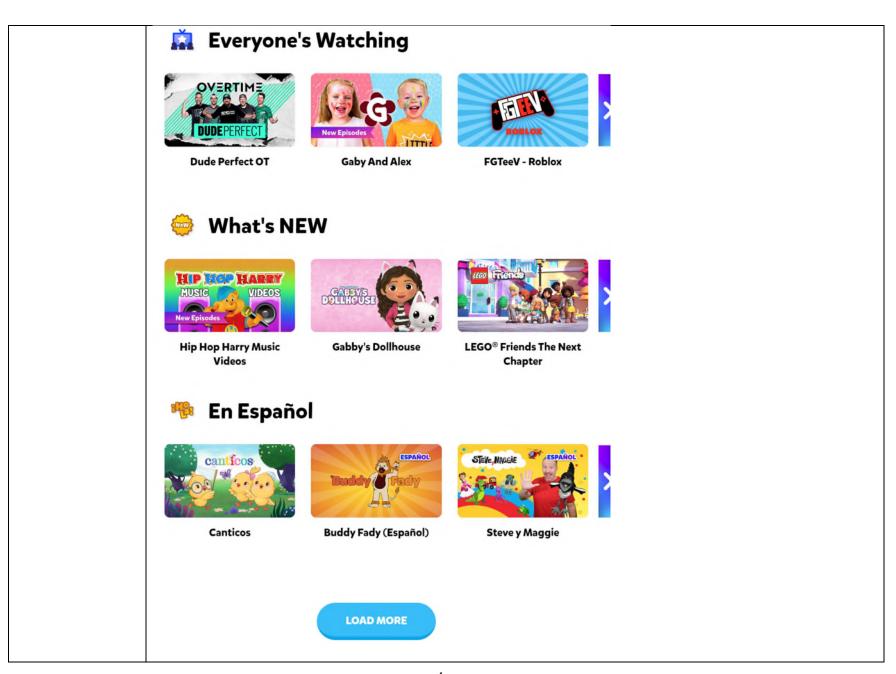
Claim Element	Example Infringement Evidence				
[16.pre] An end user station to stream a live event video over a network from a	Kidoodle includes information and Applications that include an end user content player device which streams a video over a network from a server for playback of the video. Kidoodle is executable by devices that obtain streams of a selected video program for playback. The streams include live streams that are obtained from one more servers affiliated with Kidoodle over a network.				
server for playback of the video, the content player device	The images in this chart are from a de Microsoft Edge, Google Chrome, or https://about.kidoodle.tv/ ("We're av	jor web browsers. See			
comprising:					
	Curated Content	Parental Controls	Easy-to-Watch		
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes, curfews, analytics,</b> and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.		
https://about.kidoodle.tv/ ("We're available across all available platforms.")					

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Example Infringement Evidence
Kidoodle also includes applications for all platforms, including Apple App Store for iOS devices, Google Play for Android devices, Roku, and Amazon Fire TV, which also access the Kidoodle.tv website to stream video content. See <a href="https://about.kidoodle.tv/watch-now/">https://about.kidoodle.tv/watch-now/</a>
KiDoodlett
Download our App!
Download on the App Store Google Play Roku Available on the Channel Store WATCH ON amazon fireTV
https://about.kidoodle.tv/watch-now/
Upon information and belief, the aforementioned device that accesses Kidoodle.tv through a website, and the applications that access Kidoodle.tv (collectively, "End User Device") operate in the same or substantially the same way for purposes of this chart.

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Example Infringement Evidence	
The one or more servers accessible by Kidoodle store video files which are streamed to the end user stations.	
The following are examples of the videos that may be streamed from the one or more servers to the End User	
Device(s). See <a href="https://kidoodle.tv/">https://kidoodle.tv/</a> .	



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Claim Element	Example Infringement Evidence		
	https://kidoodle.tv/.  Tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the media player embedded in the Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.  Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed and the materials.		
	on the user's device.  With respect to adaptively receiving the digital stream from the video server over the network, the media player embedded in the Kidoodle.TV site accesses adaptive bitrate streams are provided to the media player from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.		
[16.1] a processor;	Kidoodle's content is accessible on End User Devices. https://about.kidoodle.tv/ ("We're available across <b>all available platforms</b> ."). Example end user devices include personal computers, Macintosh computers, Apple iPhones, Apple iPads, Android phones, Android tablets, and smart TV devices equipped to access the internet via one or more network connections. The end users' devices include a processor configured to enable video streaming.		

Claim Element		<b>Example Infringement Evidence</b>	
	***************************************		
	Curated Content	Parental Controls	Easy-to-Watch
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes, curfews, analytics,</b> and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
	See https://about.kidoodle.tv/ ("We're	available across all available platform	ms.")
		doodle website are from accessing the Fon and belief, at least one of the device:	
[16.2] a digital processing apparatus memory device comprising non-transitory machine-readable	personal computers, Macintosh compositions are TV devices equipped to access include a processor configured to enable having non-transitory machine-readab	ent is accessible on end users' devices. uters, Apple iPhones, Apple iPads, And the internet via one or more network coole video streaming. The end users' devile instructions that cause an end user duser station and the one or more server	droid phones, Android tablets, and onnections. The end users' devices vices also include memory devices device to establish one or more
instructions that, when executed,	Through the established network conn	nection, the devices streaming Kidoodle lay on the devices via the video player	e access video programs that are

Claim Element	Example Infringement Evidence		
cause the processor to:	also		
establish one or more network connections between the end user station and	***		
the server, wherein	Curated Content	Parental Controls	Easy-to-Watch
the server is configured to access at least one of a plurality of	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes, curfews, analytics,</b> and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
groups of streamlets;	See https://about.kidoodle.tv/ ("We're	available across all available platfor	ms.")
	segments of a video program, and eac streams, or variant playlists, comprise	odle.TV video programs store streamlers a plurality of streamlets at the same ablayback of the streams at a resolution	rous resolutions. Each of the stored resolution. The arrangements of each
		deo titled "Dude Perfect," the end user more Kidoodle servers, and made an st located at the following path:	
	(hereafter referred to as the "Master I	tent/elemental-source/web/2545/9419 Manifest" or "manifest.m3u8"). The later than the source Indicators ("URIs") of	Master Manifest returned the
	#EXTM3U		

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Claim Element	Example Infringement Evidence
	#EXT-X-VERSION:3
	#EXT-X-STREAM-INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	8.m3u8
	#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"
	7.m3u8
	#EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	6.m3u8
	#EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"
	5.m3u8
	File path: manifest.m3u8
	The master playlist shows four versions of the video stream at the following bandwidths:
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each variant playlist, or version playlist, is defined by the token associated with the stream file path. For example:

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Claim Element	Example Infringement Evidence		
	Bandwidth	Token <sup>1</sup>	
	300000 Bandwidth	8.m3u8?	
	1800000 Bandwidth	7.m3u8?	
	500000 Bandwidth	6.m3u8?	
	800000 Bandwidth	5.m3u8?	
	various qualities. F <b>500000 or 800000</b>	playlists includes segments, or streamlets, that encode the same portion of the video at for example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000</b> in can be considered a high-quality stream.	
		HTTPS GET requests to retrieve the segments, or streamlets, of the encoded video specified om the one or more servers hosting Kidoodle content.	
	different copies, as	for each of the Variant Streams identifies a group of streamlets associated with each of the the exemplary Media Playlist shown below illustrates. <i>See</i> RFC 8216 at 38 ("The server a Playlist file (Section 4) that contains a URI for each Media Segment that the server wishes	

<sup>&</sup>lt;sup>1</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence				
	to make available, in the order in which they are to be played."); see also RFC 8216 at 4 ("A multimedia presentation is specified by a Uniform Resource Identifier (URI) [RFC3986] to a Playlist."); RFC 8216 at 4 ("Media Playlist contains a series of Media Segments that make up the overall presentation. A Media Segment is specified by a URI and optionally a byte range.").  As shown by the Charles Proxy application file, partially reproduced below, the streamlet video files are hoster on a server accessible via https://vcdm-cf.kidoodle.tv/. The server accesses the stored streamlet files for playback on an end user device.			is	
	Method	Host	Path <sup>2</sup>	 Status	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 0.ts?	 Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 1.ts?	 Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 2.ts?	 Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 3.ts?	 Complete	
		1	1		

<sup>&</sup>lt;sup>2</sup> Video path abbreviated for readability throughout.

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Claim Element	Example Infringement Evidence		
	Importantly, the test video "Dude Perfect" is a video uploaded to servers hosting Kidoodle content. On information and belief, the live event videos offered to Kidoodle viewers are similarly encoded at multiple resolutions, hosted on one or more servers, and accessed through HTTP Get Requests by end users' devices, such that they similarly perform the demonstrated claim limitations.		
	As shown in the test data, the End User Device accessing Kidoodle.TV selects the <b>1800000 Bandwidth</b> version of the stream and makes a request for the corresponding playlist. The server(s) returns the playlist file with the following contents:		
	#EXTM3U		
	#EXT-X-VERSION:3		
	#EXT-X-TARGETDURATION:11		
	#EXT-X-MEDIA-SEQUENCE:0		
	#EXTINF:10.750000,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude0.ts?Expires=1692058230&Signat ure=X-j9VAHmYvweCM-dblOesIErSUUPPye19SnCx9oSQaIPIQ9PYd9fEqw70kunQdE0c9VdJUJT05ewHTOHxwr0fXs g1UCjh2MBBBXuSguMBNLDplNuJxeg9ZzZpeEfPNC~k-GWyC79vUAs1SasIIG1VfVy89Kb7cBiHt17-baaBU01zty90WpmmejGY~vYOoen7gdJ9v7M~z0lVVREBiyygE7A0vGww6pEpEMztwSZZ4ZoBkCdhZmLe3vjUm5MMr8nrU8n~ljj6fEYV3GeQiNlSEAApGW1qa5cNtQOhfX2ClzKrGHx paXUKqEheDRGyCs2u3bOEHjqRm2o1-ynSK5rFw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.250000,		
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude1.ts?Expires=1692058230&Signat ure=CDpwAf98XhRNKYFrCcv-		

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Claim Element	Example Infringement Evidence
	ofhY3VrgZ6T7M~dt8AXR4VRuOrMTiwDrlCQfZ01vbPEmfi~L0OK6K9Y6rlItw3hSboVNYc-Bs8Kxtaqz~kiDoN3TvSHmiaPcpjGO03IQ5nLbwn-gcptixhXoqmhAYSfFJ8q1NrOHvq5WzlOKvx8v10snMl1mxS0fC5VRDXEYbkCvLSqe8OBa8kev2TqT8dZw7uFepqygtWzr5C0u-6nWGZHqw4vC0d~N50BQSxQ5bjMz28sAs1vw2KmnoYx4exlNb1EE6M6nUPCA3C9dc5tei7fB4UUZDjALiy3x7tOF3Zd2KJg6yxsNQC3ER8sD8g98SQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.083333,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=1692058230&Signat ure=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBd gfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok-0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signat ure=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVa HEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLf DUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence		
	#EXTINF:10.416667,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signat ure=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA#EXTINF:10.125000,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=1692058230&Signat ure=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53RunAwQ~p3j4P6 3FEfL-ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4ahEG-et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZpKD6UQPz8JI4 OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signat ure=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFd SviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0 wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1		
	b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75YdM91BCDnFgTaB2DGh		

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Claim Element	Example Infringement Evidence		
	w9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.500000,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signat ure=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.750000,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=1692058230&Signat ure=BA-		
	QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8IS2H2uktgoA vqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-		
	bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT1CCM4eWrFn IrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2- y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.125000,		
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=1692058230&Signat ure=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9uG1gv6uaDU		
	F-NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPfN~kJVa94-		

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Claim Element	Example Infringement Evidence
	XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDACytArwL9~CtJ qifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw- rtvvpM2YO35x3QnHMYJlpNjIg-vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692058230&Signa ture=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J39C0TOfHfhkuWX3GNV~B 7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk 6YyHaHA~YwMvSqF0FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692058230&Signature=AcGGiMOj6opQRc-iQhv-t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk2w0HmAaV5

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Claim Element	Example Infringement Evidence
	pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B- rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692058230&Signa ture=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39QN0fozRAJiDpxwfbGRLiCs cRoibOsDnp8g45-N1Dv-l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45U nLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKO etZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692058230&Signa ture=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yKA45ce57fGCLQkOTs9rLwvG KYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4l Jq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VDvolOXbtWeRISpeUtqRcyPv lEGMQsBtgT2E2IfmnXKJIPyRTR1~rR8gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude15.ts?Expires=1692058230&Signa ture=EmKhQ97V1kC2nux03LOh0AsSs8x3T5uYyPU7uQwFWokFiT5Z11XPDOYuvT4gX8H2 9x5ZwaGw9fzRPXaevWiB-ZyaBTwKdD5sNiXzC85OSWOECID-V1OWE4FK0zsvdbK5AhvJ3UvtNzufrrcBM9deA1B0PD8NLxZ9at3GlebQlcoyuvMPmcogOD 7uPWbGcRUMw~kfl6JvTlQDcqbh7Azckr8Pj85rDKpY7ffr3dNqHK45HTx4Hq8P6BJ5HsI7xXzimlgev1OuXSYnXwUib-ejbAqhnf-VcwgEuwFi2u9imp45LbHP~4ChIHJ2y5zkOvk6Vd6Rhlwe5QE~-91Ya7OA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude16.ts?Expires=1692058230&Signa ture=D9tydyyfLvc63w423qjALtY-u7peL5T09eMLvlf3qlhCt- z8xRmbnXtpHEtXxwqI~tQqCssOLXwaC-EY- 2o2wPfVMWWMVFw1vyi~T~DBrixO4J9gdgCnN7XiGrI8EbePchv5-H7e- ReOluUWsSOryzM6xfIOlM1KN- dlXCqfCpIXnyOZOwsnVFAgxZcekcLrarB8e8SpE1wobXlogjk2DGMr3GmYymTXsGFiODw XBTMuhWRcV1TARZLMK69oozNgv6-Te97KflduUeZVt6zapVj- 6Q8ZK7x7J9EFxmFwPXe7~SFFUQTxFMNJcu0esokmKOAR2tCxznBheaUR1Gag&Key- Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXT-X-CUE-OUT: 0 #EXT-X-CUE-IN		
	#EXTINF:8.375000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude17.ts?Expires=1692058230&Signa ture=G0-13akiy1zABYLlQcnx7Om3pfZaPh~26uL9- jwDy9bwyV6KOSVTJ9uknM13xLq12pki6n6V0cWIDrQvpsvz2Tl8~ewAUkjzwesP-		
	1XnJuY9tolEBNTaipdcKKeCNLw8LB9El~9einSOyMxcXmzX7ieVVlu-A~wi2GwbcMUb-		

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Claim Element	Example Infringement Evidence		
	w8OlvYZjVa9yTxzoz2TUjkHqFmJQ6NJ4rrnmzIsAyFu75W71LOHC-J1vs0dbN- S581jzsrg6WtUI9CbxM59TmAdLLJfnKS7XAgU5a0u~0ZbPF5Ne4z3xFWkif4joJCRc8E991A R18BUoyFCth3z8vJDd-uDp5M-br~nKEfRI5ZvBg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA		
	#EXT-X-ENDLIST		
	The variant playlist file is an HLS playlist. Each line in the file path		
	"361/670158/7/hls/S0E4_WorldsStrongestDude17.ts" that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the variant playlist shown above, the segments of the video are separated by commercial segments. Each of the streamlets (except the first and final streamlets of each playlist) is approximately 8-10 seconds long and returns sequential segments of the video program and/or commercial.		
	As long as the viewer continues watching the video and the bandwidth is adequate to support the chosen resolution, the end user device will continue to request (and Kidoodle.TV will provide) streamlets corresponding to the current, chosen resolution.		
[16.3] wherein the live event video is encoded at a plurality of different bitrates to	As mentioned above, Kidoodle videos are encoded at a plurality of different bitrates to create a plurality of streams including at least low, medium, and high quality streams. Each of the low, medium, and high quality streams has a streamlet that encodes the same portion of the video at a different one of the plurality of different bitrates. Each of the streamlets comprising the low, medium, and high, quality streams are stored in variant playlists comprising a group of streamlets of the same quality at a respective bit rate.		
create a plurality of streams including at least a low quality stream,	In the instant test, a personal computer accessing the Kidoodle.TV site through a web browser makes a HTTPS GET request to <b>prod.kidoodle.tv</b> for the Master Manifest of a video program titled "Dude Perfect." As shown in the excerpts of the Master Manifest below, the video available is encoded at 4 different bitrates.		
a medium quality stream, and a high quality stream,	#EXTM3U #EXT-X-VERSION:3		

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Claim Element	Example Infringement Evidence	
each of the low quality stream, the medium quality stream, and the high quality	#EXT-X-STREAM-INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"  8.m3u8  #EXT-X-STREAM-	
stream comprising a group of streamlets encoded at the same	#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2" 7.m3u8 #EXT-X-STREAM-	
respective one of the different bitrates, each	INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2" 6.m3u8	
group comprising at least first and second streamlets, each of the	#EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2" 5.m3u8	
streamlets corresponding to a	File path: manifest.m3u8	
portion of the live event video;	The master playlist shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270  • 1800000 (referred to herein as "500000 Bandwidth") having a resolution of 1280x720  • 500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270  • 800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406  For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:	

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Claim Element			Example Infringement Evidence	
	Bandwidth	Token <sup>3</sup>		
	300000 Bandwidth	8.m3u8?		
	1800000 Bandwidth	7.m3u8?		
	500000 Bandwidth	6.m3u8?		
	800000 Bandwidth	5.m3u8?		
	Each of the bandwidth streams includes segments that encode the same portion of the video at various qualities. For example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>500000 or 800000 Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000 Bandwidth</b> version can be considered a high-quality stream.			
	As shown below, each of the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program, and progressing until the final segment of the video program.			
	Bandwidth		reamlet (segment)	
	500000 Bandwid	th #I	EXTM3U	

<sup>&</sup>lt;sup>3</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence
	#EXT-X-VERSION:3
	#EXT-X-TARGETDURATION:11
	#EXT-X-MEDIA-SEQUENCE:0
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v

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Claim Element	Example Infringement Evidence
	Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv-zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW-OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0-Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY-gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude_5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- L14ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV
	Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude <mark>7</mark> .ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp
	- 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1- UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaB Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf- 1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu- xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169

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Claim Element	Example Infringement Evidence
	2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprlM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjClSg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3slh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiltN0u315rtZxKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG- AuKq0tVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c- vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf

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Claim Element	Example Infringement Evidence
	00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH-RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-0EsdN7ZUOam4P-E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:9.916667,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires= 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUVZ K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXA MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOV gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3 CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	JV28 XAx
	#EXTINF:10.333333,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6-Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kq0iI~ijh7cbzmcgb38F-mazr0uLY-Rp-E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqCeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHoBPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t-ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	Ji6to Kqd2 ISqa Hov-
	#EXTINF:9.666667, 	

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Claim Element	Example Infringement Evidence	
		#EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ

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Claim Element	Example Infringement Evidence	
	6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57- ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.416667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	

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Claim Element	Example Infringement Evidence	
Claim Element	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXIS	
	2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39	

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Claim Element	Example Infringement Evidence
	KMI-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT	

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Claim Element	Example Infringement Evidence
	8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJIPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.  Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant
	Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams

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Claim Element	Example Infringement Evidence
	are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle.TV to synchronize the media. <i>Id</i> . Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.

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Claim Element	Example Infringement Evidence	
[16.4] wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bit rate of no less than 600 kbps; and	As explained above, Kidoodle videos are encoded at a plurality of different bitrates to create a plurality of streams including at least low, medium, and high quality streams. Each of the low, medium, and high quality streams has a streamlet that encodes the same portion of the video at a different one of the plurality of different bitrates. Each of the streamlets comprising the low, medium, and high, quality streams are stored in variant playlists comprising a group of streamlets of the same quality at a respective bit rate. At least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps.  File path: manifest.m3u8  The master playlist shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270  • 1800000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270  • 500000 (referred to herein as "500000 Bandwidth") having a resolution of 720x406	
[16.5] wherein the first streamlets of each of the low quality stream, the medium quality stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes	Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player to synchronize the media. <i>Id.</i> Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.	

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Claim Element		Example Infringement Evidence
the same portion of the live event video at a different one of the different bitrates;	As shown below, each of the 500000 Bandwidth and 1800000 Bandwidth version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program and progressing until the final segment of the video program. As noted above, the variant playlist file is an HLS playlist. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV uses HTTPS GET requests to request and retrieve the segments of the encoded stream specified in the file above. The video files are hosted at vcdm-cf.kidoodle.tv, and each streamlet (except the first and final streamlets) is approximately 8-10 seconds long.  The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same segmented moments in the video.	
	Bandwidth	File line (#EXTINF: length) (portion of live stream)
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,

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Claim Element	Example Infringement Evidence	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdkIIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLIAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169	

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Claim Element	Example Infringement Evidence
	zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ-oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-Ll4ZQKe13SeDvD0M~woH-vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA

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Claim Element	Example Infringement Evidence				
	01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp - 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1- UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaB Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf- 1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-				
	xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058315&Signature=BXa7FwbB-				
	XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k-				

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Claim Element	Example Infringement Evidence				
	d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq-o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.125000,				
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG- AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c- vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.666667,				
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf 00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.916667,				
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16				

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Claim Element	Example Infringement Evidence						
	92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P-						
	E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.500000,						
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.916667,						
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx						

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Claim Element		Example Infringement Evidence
		MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:9.666667, #EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0

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Claim Element	Example Infringement Evidence				
	#EXTINF:10.083333,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RolqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ 6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57- ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.416667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj-				

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Claim Element	Example Infringement Evidence					
	PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrlvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq					
	ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I					

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Claim Element	Example Infringement Evidence				
	4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS 2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA				
	&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39				
	KMI-bCEffj1tx7HH4CKIT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,				

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Claim Element	Example Infringement Evidence					
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2U1ZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-					

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Claim Element	Example Infringement Evidence				
	ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333,				

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Claim Element	Example Infringement Evidence				
Claim Element	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXv1lkHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4Uq0KX2Nm9G~qMPevjWHzqmPKaqZWry15jXE8YGbhHp m9vDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJIPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbleQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXT-X-ENDLIST  On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above. Similarly, on information and belief, the other bandwidth version streamlets are the same durations as the 500000 Bandwidth and 1800000 Bandwidth versions.  The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; see also RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the				
	relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").				

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Claim Element	Example Infringement Evidence					
[16.6] select a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams;	The End User Device selects a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams.  HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").  As explained above, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270  • 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 480x270  • 500000 (referred to herein as "500000 Bandwidth") having a resolution of 720x406  For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:					
	Bandwidth	Token <sup>4</sup>				
	300000 Bandwidth	8.m3u8?				
	1800000 Bandwidth	7.m3u8?				

<sup>&</sup>lt;sup>4</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence					
	500000 Bandwid	6.m3u8?				
	800000 Bandwid	5.m3u8?				
	streamlets. request and the 500000 500000 Ba 1800000 B	The End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.				
	Method	Host	Path	•••	Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete	

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete
	allow Kid an integer timestam	loodle to synchronize the range of the range	n]atching content in Variant Streams media. RFC 8216 at 43. And "[e]ach Number. The Discontinuity Sequence chronize Media Segments across diffat Streams MUST have matching Dis	Medi Num erent	a Segment in a Media Playlist has aber can be used in addition to the Renditions." RFC 8216 at 39.
[16.7] place a streamlet request	The End User Device places a streamlet request to the server over the one or more network connections for the first streamlet of the selected stream.				
to the server over the one or more network connections for the first streamlet of the selected	The variant playlists file are HLS playlists. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV requests and retrieves the segments of the encoded stream specified in the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> , and each streamlet (except the first and final streamlets) is approximately 8-10 seconds long.				
stream;	The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-				

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Claim Element	Example Infringement Evidence		
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same segmented moments in the video.		
	Bandwidth Version	File line (#EXTINF: length) (portion of live stream)	
	500000 Bandwidth	#EXTM3U	
		#EXT-X-VERSION:3	
		#EXT-X-TARGETDURATION:11	
		#EXT-X-MEDIA-SEQUENCE:0	
		#EXTINF:10.083333,	
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Claim Element	Example Infringement Evidence		
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	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigUQOQg L~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr-KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLYAeE 62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~vSst-smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.416667,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42qpY mam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~LwMBsQ XOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYWoEX kJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58315&Signature=CM-bcy4GkvIZLwyvQ-		

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Claim Element	Example Infringement Evidence		
	oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2ww J4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PY WZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU 4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ3I8tv jSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwLCE WqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeBLQ 9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAVQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.500000,		
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAEPSZD a9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp-4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS-		

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Claim Element	Example Infringement Evidence		
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	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58315&Signature=BXa7FwbB-XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9HhQp rIM2EVLbLulCYs7d-NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33XEVC ubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3zvOOO m6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn604UoStbeC RxrNpEYOudkkm79k-d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq-		
	o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.125000,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsad7 BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp2vf 5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrcZyVY Sd2~kXj3CG-AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7- T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.666667,		

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Claim Element	Example Infringement Evidence		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39nk9it xzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DVPqjXH1d cm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf00w m8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35dQoPsu 4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJyml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM8Rhb F9BSiM5ETvGlSfVMmUjlAlh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvcoG m-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7igyLj hGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaGZkvaB ObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH15~o QepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqCky3EV~g yOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5EfbGv		

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Claim Element	Example Infringement Evidence		
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	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6toED9s TTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2iI~i jh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqaCeE 0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		

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Claim Element	Example Infringement Evidence		
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		#EXT-X-ENDLIST	
	1800000 Bandwidth	#EXTM3U	
		#EXT-X-VERSION:3	
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		https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGK UkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok-0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
		#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920	
		58230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYH XS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-	

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Claim Element	Example Infringement Evidence	
	ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25D xDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.416667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1s Xw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58230&Signature=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN- fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53Ru nAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4 ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZp KD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	

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Claim Element	Example Infringement Evidence		
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	#EXTINF:9.500000,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oP ERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiH hdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4 s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8 IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl- bCEffj1tx7HH4CKlT3~~9ej~ZenH-		

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Claim Element	Example Infringement Evidence	
	~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT 1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9 uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPf N~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDAC ytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.666667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	

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Claim Element	Example Infringement Evidence		
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J3 9C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2 G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0FqgXFZTeKO 3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.500000,		
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk 2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtw Vnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF- gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667,		
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39 QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT8W ~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CW		

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Claim Element	Example Infringement Evidence	
	xRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWuemvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb6A45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH6J9VWXti2HX96KWLRLluN9-xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJzcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpmvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwBRqlyB-y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-PaiId=APKAIPJESLAK2PMGD4PA	0yK WYN z~Fm 9VD bibm
	#EXT-X-ENDLIST	
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding the same portion of video as is respective counterpart in the streamlet files shown above.	ing to
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Seg MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Med Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue ininterrupted." RFC 8216 at 6; see also RFC 8216 at 45 ("A client MUST NOT assume that segments with ame Media Sequence Number in different Variant Streams or Renditions have the same position in the	lia

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Claim Element	Example Infringement Evidence				
	presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").				
	Indeed, to adapt playback between different bitrate Variant Streams, the End User Device "can use the EXTINF durations and the constraints in Section 6.2.4 to determine the approximate location of corresponding media. Once media from the new Variant Stream has been loaded, the timestamps in the Media Segments can be used to synchronize the old and new timelines precisely." RFC 8216 at 47.				
	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.				
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").				
	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and				

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Claim Element			Example Infringement Evidence	e	
		te <b>1800000 Bandwidth</b> verwing the same alongside	ersion of the streamlets. Below is an other status of the requests.	excer	pt of the Charles "Sequence"
	Method	Host	Path	•••	Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete

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Claim Element	Example Infringement Evidence
	The Kidoodle "[p]laylist files contain URIs, which clients will use to make network requests of arbitrary entities." RFC 8216 at 55. When playback starts on the video player, "[t]he client," which is the video player, "SHALL choose which Media Segment to play first from the Media Playlist." RFC 8216 at 45; <i>id.</i> at 47 ("The first segment to load is generally the segment that the client has chosen to play first (see Section 6.3.3)."). Then, "[i]n order to play the presentation normally, the next Media Segment" the video player requests and "load[s] the one with the lowest Media Sequence Number that is greater than the Media Sequence Number of the last Media Segment loaded." RFC 8216 at 47. That is, to playback normally, the video player must request a plurality of files with sequential Media Sequence Numbers/timestamps and the requests are made based on the Media Sequence Numbers/timestamps.
	As shown above, although the End User Device accessing Kidoodle.TV requests the <b>1800000 Bandwidth</b> version of the program, it quickly switches to requesting the <b>300000 Bandwidth</b> , then <b>500000 Bandwidth</b> , then back to the <b>1800000 Bandwidth</b> version when bandwidth is adjusted. Those requests, as shown above, are "Completed," meaning the streamlets were received from the one or more Kidoodle servers.
	On information and belief, playlists for the other resolution variants also include these segments, which correspond to the same portion of the video provided from the server(s).
[16.8] receive the requested first streamlet from the	The End User Device accessing Kidoodle.TV receives a streamlet request from the end user station and subsequently places a request to the video servers over the one or more network connections for the selected stream.
server via the one or more network connections; and	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").
	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and

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		the status of the requests.	s an excerpt of the Charles "Sequenc		
Method	Host	Path	•••	Status	
GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete	

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Claim Element	Example Infringement Evidence				
	Kidoodle "[p]laylist files contain URIs, which clients will use to make network requests of arbitrary entities." RFC 8216 at 55. When playback starts on the video player, "[t]he client," which is the video player accessing Kidoodle.TV, "SHALL choose which Media Segment to play first from the Media Playlist." RFC 8216 at 45; <i>id.</i> at 47 ("The first segment to load is generally the segment that the client has chosen to play first (see Section 6.3.3)."). Then, "[i]n order to play the presentation normally, the next Media Segment" the End User Device requests and "load[s] the one with the lowest Media Sequence Number that is greater than the Media Sequence Number of the last Media Segment loaded." RFC 8216 at 47. That is, to playback normally, the End User Device must request a plurality of files with sequential Media Sequence Numbers/timestamps and the requests are made based on the Media Sequence Numbers/timestamps.				
	As shown above, although the End User Device accessing Kidoodle.TV requests the <b>1800000 Bandwidth</b> version of the program, it quickly switches to requesting the <b>300000 Bandwidth</b> , then <b>500000 Bandwidth</b> , then back to the <b>1800000 Bandwidth</b> version when bandwidth is adjusted. Those requests, as shown above, are "Completed," meaning the streamlets were received from the one or more Kidoodle servers.				
[16.9] provide the received first	The End User Device accessing Kidoodle.TV provides the received streamlets to the video player embedded in the Kidoodle.TV site.				
streamlet for playback of the live event video.	In response to requesting the first streamlet via an HTTP GET request, as shown above, the End User Device accessing Kidoodle.TV receives the requested streamlet from the server via the one or more network connections. <i>See e.g.</i> , RFC 8216 at 4 ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation."); <i>id.</i> at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments.").				
	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and				

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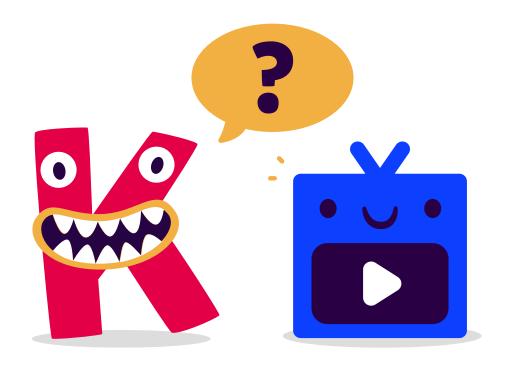
Claim Element			Example Infringement Evidence	e	
		te <b>1800000 Bandwidth</b> verwing the same alongside	ersion of the streamlets. Below is an other status of the requests.	excer	pt of the Charles "Sequence"
	Method	Host	Path	•••	Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete

Example Infringement Evidence				
Kidoodle confirms that the video player provides video playback to end user stations over a network connection on the Kidoodle support webpage, <a href="https://about.kidoodle.tv/faq/">https://about.kidoodle.tv/faq/</a> . There, Kidoodle troubleshoots problems end users may have with HLS and instructs users on how to optimize their video playback experience. See <a href="https://about.kidoodle.tv/faq/">https://about.kidoodle.tv/faq/</a> .				
Why isn't Kidoodle.TV® working?				
We have worked hard to create a service that can be accessed across as many devices as possible, but as with all technology there are times when it may not work properly. There are a number of reasons why this can happen including simple connectivity issues to more complex ones. If you're experiencing any issues, please try the following:  1. Confirm that you are connected to a WIFI network and that the connection is strong.  2. Close the app and re-launch it.  3. Sign out of your account (if you have one) and log back in.  4. Check to see if there is a recent update, and if so, update the app.  5. Delete the app from your device and re-install it.  If the problem persists, please contact us and we would be more than happy to try and find a solution.  When sonding us a massage please take note of any error codes you may see and provide as much				
When sending us a message, please take note of any error codes you may see, and provide as much detailed information as possible, including the device you're streaming on.				
Does Kidoodle.TV® work while I'm offline?  Unfortunately, Kidoodle.TV is a streaming service and as such you must be connected to a WIFI network or use data to watch.				

# **EXHIBIT N**

## Frequently Asked Questions

If you have any questions, please check here for answers, or contact us at team@kidoodle.tv!









**Getting Started** 

Safety

Utilizing Features

Cookies Policy





## What is Kidoodle.TV®?

Kidoodle.TV is a premiere streaming service devoted to providing safe, engaging, and inspiring experiences for children. We have an extensive global content library featuring over 25,000 episodes of popular TV shows, Kidoodle.TV Originals, educational and entertaining programming, gaming content and more. The content we feature varies by region with new shows added to the service regularly.

## What makes Kidoodle.TV® unique?

We remain a leader in our commitment to providing a safe space for kids—each and every show is vetted by real humans making sure it's appropriate for all audiences.

## How can I watch Kidoodle.TV®?

We're available on a wide variety of devices and numerous platforms making it accessible to your family when and where you want to **watch Kidoodle.TV**.

#### What is the Parents Room?

The Parents Room is your one-stop shop to managing your Kidoodle.TV® account settings and child's profiles. The Parents Room can be accessed from the Kidoodle.TV app on your mobile device or our **website**. Once accessed, you can customize your child's profile, manage your subscription, update billing information, access useful information on your child's screen time, adjust parental controls, and toggle shows on and off. Note: you must have a Freemium or Premium account to access the Parents Room.

#### Where is Kidoodle.TV® available?

Kidoodle.TV is available in over 160 countries and regions across the world. To access in your region, visit the **Apple App Store** or **Google Play** or any way you access Kidoodle.TV.

#### Is Kidoodle.TV® free?

On **Kidoodle.TV** you can watch your favorite shows for free (ad-supported). There's no obligation to sign up or create an account. However, creating an account allows you to access the Parents Room where you can use our parental controls such as setting bedtime hours, choosing age-appropriate shows, or viewing without ads (Premium accounts only). Premium account fees vary depending on region. You can choose the experience that best fits your family

You can choose the experience that best fits your family here.

#### How do I remove ads?

If you wish to remove ads from your viewing experience, you can upgrade to our Premium plan for only \$4.99USD per month. View our account options **here** 

## How do I upgrade or change my plan?

You can create a Freemium account on your mobile or streaming device. To upgrade to a Premium plan or change your account details you can log into your account **here**, enter the Parents Room, then click on Parents Account and make changes.

#### How can I watch Kidoodle.TV® on the web?

You'll first need to have Adobe Flash installed in order to watch on the web. If you still run into issues, please try the following steps:

- 1) In the URL field of your browser, find the lock icon at the far left, click on that.
- 2) Click on "Site Settings".
- 3) A new page will open, scroll down to flash.
- 4) Change from "ask (default)" to "allow".
- 5) Go back to the browser, it should ask you to reload and allow you to watch.

# What's the video quality of **Kidoodle.TV®** programming?

We show only high quality, adaptive bit rate streaming of our shows direct to your devices, with up to 8K resolution.

# Download our App!

Get Kidoodle.TV® on your device of choice.

Download the app and start watching for free today!











OUR OFFICE NAVIGATION SOCIAL

Suite 320 Home Watch Now **f y ⊙** 

333 - 24th Avenue SW Our Story Login/Signup

Calgary, AB Careers FAQ

Canada T2S 3E6 Advertise With Us Terms of Use

School Giveaway Privacy Policy

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# Click to learn more!

Social Impact is an initiative of A Parent Media Co. Inc.

# **EXHIBIT O**

#### **U.S. Patent No. 11,677,798 to Kidoodle**

The following claim chart shows exemplary aspects of A Parent Media Co. Inc.'s Kidoodle.TV streaming services and products ("Kidoodle") that infringe claim 1 of the '798 Patent. The chart is exemplary and should not be read to limit DISH's assertions against Kidoodle, or any other streaming services offered by A Parent Media Co. Inc. or Kidoodle as to the services or products described below. The chart should not be read to limit DISH's assertions to the patent claim charted below. Nor should the chart below be read to limit how Kidoodle infringes the claim below.

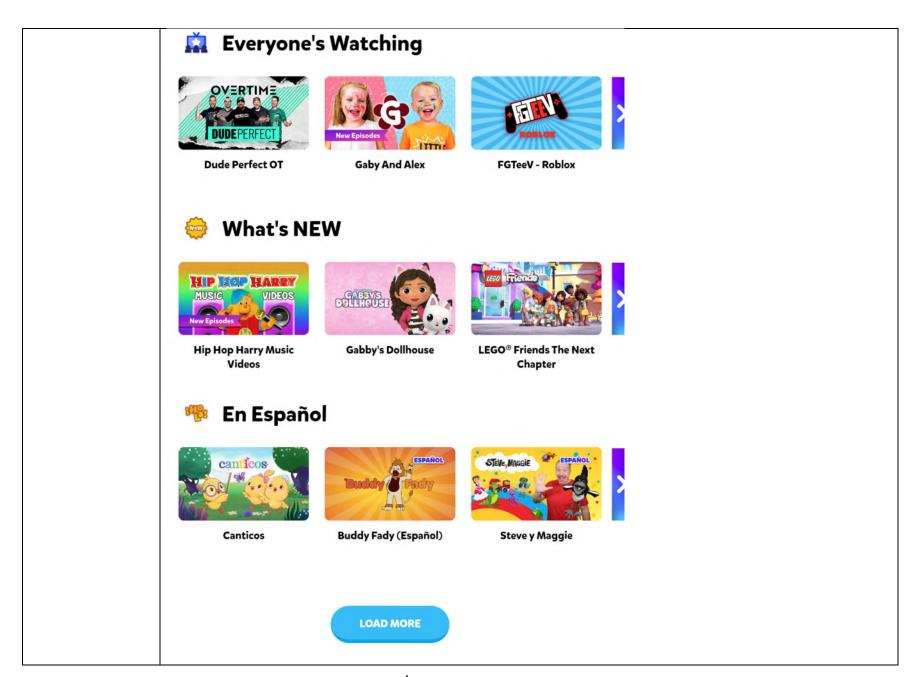
Claim Element	Example Infringement Evidence			
[11.pre] An end user station comprising:	network from a server for playback of	applications that include an end user state of the video. Kidoodle is executable by a The streams include live streams that a a network.	levices that obtain streams of a	
	Microsoft Edge, Google Chrome, or	evice accessing the Kidoodle.tv website iOS Safari. Kidoodle.tv supports all ma ailable across all available platforms."	jor web browsers. See	
	Curated Content	Parental Controls	Easy-to-Watch	
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes, curfews, analytics,</b> and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.	
	https://about.kidoodle.tv/ ("We're av	ailable across <b>all available platforms</b> ."	)	

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Claim Element	Example Infringement Evidence
	Kidoodle also includes applications for all platforms, including Apple App Store for iOS devices, Google Play for Android devices, Roku, and Amazon Fire TV, which also access the Kidoodle.tv website to stream video content. See <a href="https://about.kidoodle.tv/watch-now/">https://about.kidoodle.tv/watch-now/</a>
	KiDood@
	Download our App!
	Download on the App Store Google Play Roku: Available on the Channel Store watch on amazon fireTV
	https://about.kidoodle.tv/watch-now/
	Upon information and belief, the aforementioned device that accesses Kidoodle.tv through a website, and the applications that access Kidoodle.tv (collectively, "End User Device") operate in the same or substantially the same way for purposes of this chart.

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Claim Element	Example Infringement Evidence
	The one or more servers accessible by Kidoodle store video files which are streamed to the end user stations.  The following are examples of the videos that may be streamed from the one or more servers to the End User
	Device(s). See <a href="https://kidoodle.tv/">https://kidoodle.tv/</a> .



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Claim Element	Example Infringement Evidence		
	https://kidoodle.tv/.  Tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the <a href="media player embedded in the">media player embedded in the</a> Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.  Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed		
	on the user's device.  With respect to adaptively receiving the digital stream from the video server over the network, the <a href="mailto:media player embedded in the">media player embedded in the</a> Kidoodle. TV site accesses adaptive bitrate streams are provided to the End User Device from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.		
[11.1] a processor,	Kidoodle's content is accessible on End User Devices. https://about.kidoodle.tv/ ("We're available across all available platforms."). Example end user devices include personal computers, Macintosh computers, Apple iPhones, Apple iPads, Android phones, Android tablets, and smart TV devices equipped to access the internet via one or more network connections. The end users' devices include a processor configured to enable video streaming.		

Claim Element		Example Infringement Evidence	
	<b>* * * * * * * * * *</b>		
	Curated Content	Parental Controls	Easy-to-Watch
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes</b> , <b>curfews</b> , <b>analytics</b> , and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
	See https://about.kidoodle.tv/ ("We're	e available across <b>all available platfor</b>	ms.")
		idoodle website are from accessing the formation and belief, at least one of the processor.	11
[11.2] a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed,	personal computers, Macintosh compositions are TV devices equipped to access include a processor configured to enal having non-transitory machine-readal internet connections between the end	ent is accessible on end users' devices. Souters, Apple iPhones, Apple iPads, Anothe internet via one or more network couble video streaming. The end users' deble instructions that cause an end user of user station and the one or more server access at least one of a plurality of ground stream of the couple instructions and the one or more server access at least one of a plurality of ground stream of the couple instructions.	droid phones, Android tablets, and onnections. The end users' devices vices also include memory devices device to establish one or more rs hosting Kidoodle videos, and the

Claim Element	Example Infringement Evidence				
cause the	Through the established network connection, the devices streaming Kidoodle access video programs that are				
processor to:	<u>-</u>	play on the devices via the video player	accessing the Kidoodle.TV site. See		
establish one or	also				
more network					
connections between the end	<b>*</b>	ê <sup>Q</sup> €			
user station and at least one server,	4				
wherein the at					
least one server is	Curated Content	Parental Controls	Easy-to-Watch		
configured to	No fancy algorithms here. Every show	Be the best parent, even when you're not	Whether you have a tablet, smart tv, or		
access at least one	available on our service has been watched and screened by a <b>real human</b>	there. Bedtimes, curfews, analytics, and	mobile phone, Kidoodle.TV is there for you. We're available across all available		
of a plurality of groups of	being.	more features are available to all users.	platforms.		
streamlets of					
digital content;	See https://about.kidoodle.tv/ ("We're	e available across all available platfor	ms.")		
	The one or more servers hosting Kido	oodle.TV video programs store streamle	ets corresponding to particular		
		ch streamlet is encoded at one of numer			
		es a plurality of streamlets at the same	C		
	bandwidth.	playback of the streams at a resolution	supported by the available network		
	For example, in the instant test of a video titled "Dude Perfect," the end user station: established a network				
	connection, connected with the one or more Kidoodle servers, and made an HTTP GET request to				
	prod.kidoodle.tv for a master manife	est located at the following path: htent/elemental-source/web/2545/941	52/670158/watch/manifact m3u8		
		Manifest" or "manifest.m3u8"). The l			

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Claim Element	Example Infringement Evidence
	following contents, reflecting the Uniform Resource Indicators ("URIs") of the various variant playlists hosting at least a group of streamlets:
	#EXTM3U
	#EXT-X-VERSION:3
	#EXT-X-STREAM- INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	8.m3u8
	#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"
	7.m3u8
	#EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	6.m3u8
	#EXT-X-STREAM-INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"
	5.m3u8
	File path: manifest.m3u8
	The master playlist shows four versions of the video stream at the following bandwidths:
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>

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Claim Element	Example Infringement Evidence		
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each variant playlist, or version playlist, is defined by the token associated with the stream file path. For example:		
	Bandwidth	Token <sup>1</sup>	
	300000 Bandwidth	8.m3u8?	
	1800000 Bandwidth	7.m3u8?	
	500000 Bandwidth	6.m3u8?	
	800000 Bandwidth	5.m3u8?	
	various qualities. <b>500000 or 80000</b>	nt playlists includes segments, or streamlets, that encode the same portion of the video at For example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>300000 Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000</b> ion can be considered a high-quality stream.	

<sup>&</sup>lt;sup>1</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence				
	Kidoodle also uses HTTPS GET requests to retrieve the segments, or streamlets, of the encoded video specified in the file above from the one or more servers hosting Kidoodle content.  The Media Playlist for each of the Variant Streams identifies a group of streamlets associated with each of the different copies, as the exemplary Media Playlist shown below illustrates. <i>See</i> RFC 8216 at 38 ("The server				
	must create a Media Playlist file (Section 4) that contains a URI for each Media Segment that the server wishes to make available, in the order in which they are to be played."); <i>see also</i> RFC 8216 at 4 ("A multimedia presentation is specified by a Uniform Resource Identifier (URI) [RFC3986] to a Playlist."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation. A Media Segment is specified by a URI and optionally a byte range.").  As shown by the Charles Proxy application file, partially reproduced below, the streamlet video files are hosted			4 ("A ent is	
		on an end user device.	Path <sup>2</sup>	esses the stored streamlet files for	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 0.ts?	 Status Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 1.ts?	 Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 2.ts?	 Complete	

<sup>&</sup>lt;sup>2</sup> Video path abbreviated for readability throughout.

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Claim Element		Example Infringement Evidence			
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 3.ts?		Complete
	information resolutions such that the As shown for the core	n and belief, the live even s, hosted on one or more so hey similarly perform the in the test data, Kidoodle	t videos offered to Kidoodlervers, and accessed throug demonstrated claim limitat selects the <b>1800000 Bandy</b>	le viewer gh HTTP ions. <b>vidth</b> ver	s hosting Kidoodle content. On a sare similarly encoded at multiple Get Requests by end users' devices, sion of the stream and makes a request at file with the following contents:
	#E	XT-X-VERSION:3			
	#E	XT-X-TARGETDURATI	ON:11		
	#E	XT-X-MEDIA-SEQUEN	CE:0		
	#E	XTINF:10.750000,			
	cf ure dbi g1 GV baa Zo pal	=X-j9VAHmYvweCM- lOesIErSUUPPye19SnCx9 UCjh2MBBBXuSguMBN VyC79vUAs1SasIIG1VfV nBU01zty90WpmmejGY~ BkCdhZmLe3vjUm5MM	9oSQaIPIQ9PYd9fEqw70k LDplNuJxeg9ZzZpeEfPNo 7y89Kb7cBiHt17- vYOoen7gdJ9v7M~z0lVV r8nrU8n~ljj6fEYV3GeQiN EHjqRm2o1-ynSK5rFw_	kunQdE0 C~k- /REBiyy JISEAAp	s?Expires=1692058230&Signat c9VdJUJT05ewHTOHxwr0fXs gE7A0vGww6pEpEMztwSZZ4 GW1qa5cNtQOhfX2ClzKrGHx air-

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Claim Element	Example Infringement Evidence		
	#EXTINF:9.250000, https://vcdm-		
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude1.ts?Expires=1692058230&Signat ure=CDpwAf98XhRNKYFrCcv-		
	ofhY3VrgZ6T7M~dt8AXR4VRuOrMTiwDrlCQfZ01vbPEmfi~L0OK6K9Y6rlItw3hSboVNYc-Bs8Kxtaqz~kiDoN3TvSHmiaPcpjGO03IQ5nLbwn-		
	gcptixhXoqmhAYSfFJ8q1NrOHvq5WzlOKvx8v10snMl1mxS0fC5VRDXEYbkCvLSqe8OBa8 kev2TqT8dZw7uFepqygtWzr5C0u-		
	6nWGZHqw4vC0d~N50BQSxQ5bjMz28sAs1vw2KmnoYx4exlNb1EE6M6nUPCA3C9dc5tei7 fB4UUZDjALiy3x7tOF3Zd2KJg6yxsNQC3ER8sD8g98SQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.083333,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=1692058230&Signat ure=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBd gfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok-0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.333333,		
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signat ure=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVa HEnwXrSS4IRE0hHiU2tSZwupiy57B~-		
	ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLf DUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-		

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Claim Element	Example Infringement Evidence
	eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57- ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw &Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signat ure=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=1692058230&Signat ure=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53RunAwQ~p3j4P6 3FEfL-ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4ahEG-et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZpKD6UQPz8JI4 OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signat ure=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb-

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Claim Element	Example Infringement Evidence	
	p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1 b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75YdM91BCDnFgTaB2DGh w9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signat ure=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=1692058230&Signat ure=BA-QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=1692058230&Signat ure=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA-	

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Claim Element	Example Infringement Evidence
	P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9uG1gv6uaDU F-NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPfN~kJVa94-XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg-vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB 0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW 4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692058230&Signa ture=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J39C0TOfHfhkuWX3GNV~B 7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk 6YyHaHA~YwMvSqF0FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692058230&Signa

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Claim Element	Example Infringement Evidence	
	ture=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk2w0HmAaV5 pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B- rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692058230&Signa ture=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39QN0fozRAJiDpxwfbGRLiCs cRoibOsDnp8g45-N1Dv-l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45U nLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKO etZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692058230&Signa ture=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yKA45ce57fGCLQkOTs9rLwvG KYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4l Jq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VDvolOXbtWeRISpeUtqRcyPv IEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	

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Claim Element	Example Infringement Evidence	
	#EXTINF:9.458333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude15.ts?Expires=1692058230&Signa ture=EmKhQ97V1kC2nux03LOh0AsSs8x3T5uYyPU7uQwFWokFiT5Z11XPDOYuvT4gX8H2 9x5ZwaGw9fzRPXaevWiB-ZyaBTwKdD5sNiXzC85OSWOECID- V1OWE4FK0zsvdbK5AhvJ3UvtNzufrrcBM9deA1B0PD8NLxZ9at3GlebQlcoyuvMPmcogOD 7uPWbGcRUMw~kfl6JvTlQDcqbh7Azckr8Pj85rDKpY7ffr3dNqHK45HTx4Hq8P6BJ5HsI7 xXzimlgev1OuXSYnXwUib-ejbAqhnf- VcwgEuwFi2u9imp45LbHP~4ChIHJ2y5zkOvk6Vd6Rhlwe5QE~-91Ya7OA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude16.ts?Expires=1692058230&Signa ture=D9tydyyfLvc63w423qjALtY-u7peL5T09eMLvlf3qIhCt- z8xRmbnXtpHEtXxwqI~tQqCssOLXwaC-EY- 2o2wPfVMWWMVFw1vyi~T~DBrixO4J9gdgCnN7XiGrI8EbePchv5-H7e- ReOIuUWsSOryzM6xfIOIM1KN- dlXCqfCpIXnyOZOwsnVFAgxZcekcLrarB8e8SpE1wobXIogjk2DGMr3GmYymTXsGFiODw XBTMuhWRcV1TARZLMK69oozNgv6-Te97KflduUeZVt6zapVj- 6Q8ZK7x7J9EFxmFwPXe7~SFFUQTxFMNJcu0esokmKOAR2tCxznBheaUR1Gag&Key- Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXT-X-CUE-OUT: 0 #EXT-X-CUE-IN #EXTINF:8.375000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude17.ts?Expires=1692058230&Signa ture=G0-13akiy1zABYLlQcnx7Om3pfZaPh~26uL9-jwDy9bwyV6KOSVTJ9uknM13xLq12pki6n6V0cWIDrQvpsvz2Tl8~ewAUkjzwesP-	

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Claim Element	Example Infringement Evidence	
	1XnJuY9tolEBNTaipdcKKeCNLw8LB9El~9einSOyMxcXmzX7ieVVlu-A~wi2GwbcMUb-w8OlvYZjVa9yTxzoz2TUjkHqFmJQ6NJ4rrnmzIsAyFu75W71LOHC-J1vs0dbN-S581jzsrg6WtUI9CbxM59TmAdLLJfnKS7XAgU5a0u~0ZbPF5Ne4z3xFWkif4joJCRc8E991ARl8BUoyFCth3z8vJDd-uDp5M-br~nKEfRI5ZvBg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXT-X-ENDLIST	
	The variant playlist file is an HLS playlist. Each line in the file path "361/670158/7/hls/S0E4_WorldsStrongestDude17.ts" that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the variant playlist shown above, the segments of the video are separated by commercial segments. Each of the streamlets (except the first and final streamlets of each playlist) is approximately 8-10 seconds long and returns sequential segments of the video program and/or commercial.  As long as the viewer continues watching the video and the bandwidth is adequate to support the chosen resolution, the end user device will continue to request (and Kidoodle.TV will provide) streamlets corresponding to the current, chosen resolution.	
[11.3] wherein the digital content is encoded at a plurality of different bit rates	The digital content (e.g., Kidoodle videos) is encoded at a plurality of different bit rates to create a plurality of streams including at least a first bit rate stream, a second bit rate stream, and a third bit rate stream, wherein each of the first bit rate stream, the second bit rate stream, and the third bit rate stream comprises a group of streamlets encoded at the same respective one of the different bit rates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the digital content.	
to create a plurality of streams including at least a first bit rate stream, a	In the instant test, a personal computer accessing the Kidoodle.TV site through a web browser makes a HTTPS GET request to <b>prod.kidoodle.tv</b> for the Master Manifest of a video program titled "Dude Perfect." As shown in the excerpts of the Master Manifest below, the video available is encoded at 4 different bitrates.	

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Example Infringement Evidence	
#EXTM3U	
#EXT-X-VERSION:3	
#EXT-X-STREAM-	
INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"	
8.m3u8	
#EXT-X-STREAM-	
INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"	
7.m3u8	
#EXT-X-STREAM-	
INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"	
6.m3u8	
#EXT-X-STREAM-	
INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"	
5.m3u8	
File path: manifest.m3u8	$\dagger$
The master playlist shows four versions of the video stream at the following bandwidths:	
• 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270	
• 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720	
<ul> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>	
	#EXTM3U #EXT-X-VERSION:3 #EXT-X-STREAM- INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2" 8.m3u8 #EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2" 7.m3u8 #EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2" 6.m3u8 #EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2" 5.m3u8 File path: manifest.m3u8 The master playlist shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270 • 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720 • 500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270

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Claim Element		Example Infringement Evidence
	selected video pr	e versions, the master playlist provides a link to a playlist for the specified version of the ogram at a particular bandwidth and resolution. Each version playlist is defined by the token the stream file path. For example:
	Bandwidth	Token <sup>3</sup>
	300000 Bandwidth	8.m3u8?
	1800000 Bandwidth	7.m3u8?
	500000 Bandwidth	6.m3u8?
	800000 Bandwidth	5.m3u8?
	For example, the	width streams includes segments that encode the same portion of the video at various qualities.  300000 Bandwidth version can be considered a low-quality stream, the 500000 or 800000 ion can be considered a medium-quality stream, and the 1800000 Bandwidth version can be n-quality stream.
		, each of the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> version playlists contain segments, it encode segments of the video program. The streamlet files within each version playlist are

<sup>&</sup>lt;sup>3</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence	
	arranged in ascending chronological order, beginning with the first segment of the video program, and progressing until the final segment of the video program.		
	Bandwidth		
	Danawiaui	Streamlet (segment)	
	500000 Bandwidth	#EXTM3U	
		#EXT-X-VERSION:3	
		#EXT-X-TARGETDURATION:11	
		#EXT-X-MEDIA-SEQUENCE:0	
		#EXTINF:10.083333,	
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333,	
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169	
		2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU	

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Claim Element	Example Infringement Evidence	
	QQQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdkIIwDJPt16Cyeqhr-KwvR15XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLIAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam-Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWx13gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDtrTXHtU5IKsfY- gRCPydn4wdxbf9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOMWtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJIbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-	
	Ll4ZQKe13SeDvD0M~woH-	

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Claim Element	Example Infringement Evidence
	vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12IL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJID6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp - 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1- UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaB Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf- 1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-

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Claim Element	Example Infringement Evidence	
	xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-P Id=APKAIPJESLAK2PMGD4PA	'air-
	#EXTINF:9.750000,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires= 2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33 EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8Pe zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cO 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	3X eE3
	#EXTINF:10.125000,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=2058315&Signature=NMtzBCclF1SeF9lDw3slh3PwsEJPGn-IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5Ld7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO-V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~92vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGvZyVYSd2~kXj3CG-AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJdvSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	LPsa OfSp wrc
	#EXTINF:10.666667,	

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Claim Element	Example Infringement Evidence	
Claim Element	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee-Prnd4PsTrFl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf 00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1J01YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGISfVMmUjlAlh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWpIU25CPSygP9iRw4tkjqaG	
	ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-	

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Claim Element	Example Infringement Evidence
	qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.3333333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-

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	BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.666667,
	#EXT-X-ENDLIST
1800000 Bandwidth	#EXTM3U
	#EXT-X-VERSION:3
	#EXT-X-TARGETDURATION:11
	#EXT-X-MEDIA-SEQUENCE:0
	•••
	#EXTINF:10.083333,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok-0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.3333333,

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~e12 5DxDRs3Pb1hLfDUDIorP0097~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ 6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57- ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-

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Claim Element	Example Infringement Evidence
	eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS 2~10PERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:9.750000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39 KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-

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Claim Element	Example Infringement Evidence
	ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu116 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00KI7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.3333333,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXv11kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST

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Claim Element	Example Infringement Evidence
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.
	Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle. TV to synchronize the media. <i>Id.</i> Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number,

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Example Infringement Evidence
where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
As explained above, Kidoodle videos are encoded at a plurality of different bitrates to create a plurality of
streams including at least low, medium, and high quality streams. At least one of the low quality stream, the
medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps.
File path: manifest.m3u8
The master playlist shows four versions of the video stream at the following bandwidths:
• 300000 (referred to herein as " <b>300000 Bandwidth</b> ") having a resolution of 480x270
• 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720
• 500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270
• 800000 (referred to herein as " <b>800000 Bandwidth</b> ") having a resolution of 720x406
The first streamlets of each of the first hit rate stream the accord hit rate stream and the third hit rate stream
The first streamlets of each of the first bit rate stream, the second bit rate stream and the third bit rate stream each has an equal playback duration and each of the first streamlets encodes the same portion of the digital
content at a different one of the different bit rates.
As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at
5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant
Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching
content in Variant Streams MUST have matching timestamps" to allow the video player to synchronize the

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Claim Element		Example Infringement Evidence
equal playback duration and each of the first streamlets encodes	media. <i>Id.</i> Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.	
the same portion of the digital content at a different one of the different bit rates;	As shown below, each of the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program and progressing until the final segment of the video program. As noted above, the variant playlist file is an HLS playlist. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV uses HTTPS GET requests to request and retrieve the segments of the encoded stream specified in the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> , and each streamlet (except the first and final streamlets) is approximately 8-10 seconds long.  The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same segmented moments in the video.	
	Bandwidth	File line (#EXTINF: length) (portion of live stream)
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11

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Claim Element	Example Infringement Evidence
	#EXT-X-MEDIA-SEQUENCE:0  #EXTINF:10.083333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6-
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	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence		
	92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.500000,		
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667,		
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-		

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Claim Element	Example Infringement Evidence
	ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above. Similarly, on information and belief, the other bandwidth version streamlets are the same durations as the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> versions.
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; <i>see also</i> RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the

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Claim Element	Example Infringement Evidence			
	•	sts MAY have independent Media Sequence Numbers. Instead, a client MUST use the each segment on the Playlist timeline and its Discontinuity Sequence Number to locate nents.").		
[11.6] determine whether to select a higher or lower bit		Device determines whether to select a higher or lower bit rate copy of the stream and based on ion, select a specific one of the first bit rate stream, the second bit rate stream, and the third bit receiver to adapt the bitrate of the media to the current network conditions in order to maintain layback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client ontinuous stream of media from a server for concurrent presentation.").  Boove, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the the following bandwidths:  (referred to herein as "300000 Bandwidth") having a resolution of 480x270 (referred to herein as "500000 Bandwidth") having a resolution of 480x270 (referred to herein as "500000 Bandwidth") having a resolution of 720x406		
rate copy of the stream and based on that determination,	uninterrupted playb			
select a specific one of the first bit	_			
rate stream, the second bit rate stream, and the third bit rate stream;	• 1800000 (ref			
	selected video prog	ersions, the master playlist provides a link to a playlist for the specified version of the ram at a particular bandwidth and resolution. Each version playlist is defined by the token stream file path. For example:		
	Bandwidth	Token <sup>4</sup>		
	300000 Bandwidth	8.m3u8?		

<sup>&</sup>lt;sup>4</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence					
	1800000 Bandwid	7.m3u8?				
	500000 Bandwid	6.m3u8?				
	800000 Bandwid	5.m3u8?				
	streamlets. request and the 500000 500000 Ba 1800000 B	Upon a determination that receive the 300000 Band Bandwidth version of the standwidth version of	oodle.TV requests and receives the 1st the higher bitrate cannot be supported dwidth version of the streamlets. The streamlets can be supported, and streamlets. Then, the End User Device streamlets can be supported, and substreamlets. Below is an excerpt of the requests.	ted, to e End ubsection then seque	he End User Device switches I User Device then determine quently requests and receives a determines that the higher ently requests and receives the	es to es that the
	Method	Host	Path	•••	Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete	

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete
	allow Kid an integer timestamp	coodle to synchronize the notes Discontinuity Sequence Nos within the media to synchlatching content in Varian	n]atching content in Variant Streams nedia. RFC 8216 at 43. And "[e]ach Number. The Discontinuity Sequence chronize Media Segments across diff at Streams MUST have matching Dis	Medi Num erent	a Segment in a Media Playlist has aber can be used in addition to the Renditions." RFC 8216 at 39.
[11.7] place a first streamlet request to the at least one server over the one or more network connections for the first streamlet of	The variation of the seguine the file	ns for the first streamlet of nt playlists file are HLS pl ments in seconds. The line User Device accessing Kido	aylists. Each line in the file that beging below the #EXTINF file is the local bodle.TV requests and retrieves the substant of the hosted at vcdm-cf.kidoodle.tv, and	ns wi tion o egme	th "#EXTINF" specifies the length of the video file. In the present test, nts of the encoded stream specified

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Claim Element		Example Infringement Evidence	
the selected stream;	The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-		
		E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same video.	
	Bandwidth Version	File line (#EXTINF: length) (portion of live stream)	
	500000 Bandwidth	#EXTM3U  #EXT-X-VERSION:3  #EXT-X-TARGETDURATION:11  #EXT-X-MEDIA-SEQUENCE:0   #EXTINF:10.083333,	
		https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58315&Signature=fvGyZzCNd-crO6-JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-ERIBXKGkK~uCNrFq64LsvX~X~EPT8I5qybYZUit-SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMvfBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb-4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr-8Zf6oIUQQca-	

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Claim Element	Example Infringement Evidence	nt
	5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg& Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigUQOQg L~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr-KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLYAeE 62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~vSst-smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.416667,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42qpY mam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~LwMBsQ XOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYWoEX kJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	

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Claim Element	Example Infringement Evidence		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2ww J4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PY WZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU 4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ3I8tv jSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwLCE WqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeBLQ 9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAVQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAEPSZD a9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp- 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-		

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Claim Element	Example Infringement Evidence		
	UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~ 4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR- anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS- EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.750000,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58315&Signature=BXa7FwbB- VvKzimylOsEldShl D7Dm8Eygl dNIEW0ioOmgOp3IvggMyvDM0, DTS0HbOp		
	XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9HhQp rIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33XEVC ubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3zvOOO m6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn604UoStbeC RxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq-		
	o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.125000,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsad7 BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp2vf 5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrcZyVY Sd2~kXj3CG-AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7- T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		

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Claim Element	Example Infringement Evidence		
	#EXTINF:10.666667,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39nk9it xzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DVPqjXH1d cm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf00w m8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35dQoPsu 4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJyml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667,		
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM8Rhb F9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH-RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvcoG m-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-0EsdN7ZUOam4P-E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7igyLj hGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaGZkvaB ObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH15~o QepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqCky3EV~g yOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-qVVkpgIZkF1HrUvTWvHcEXkVv		

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Claim Element	Example Infringement Evidence		
	tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5EfbGv ~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4-jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987-4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA#EXTINF:9.916667,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28K9 4BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAxMXU8 Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVCgt Qgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3sCeV vdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6toED9s TTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2iI~i jh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqaCeE 0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-		

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Claim Element		Example Infringement Evidence
		BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:9.666667,
		#EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGK UkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333,

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Claim Element	Example Infringement Evidence
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYH XS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25D xDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80Lz LrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ- zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1s Xw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58230&Signature=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN- fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53Ru nAwQ~p3j4P63FEfL-
	ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4

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Claim Element	Example Infringement Evidence	Claim Element
	ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZp KD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb7YdM91BCDnFgTaB2DGhw9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~10ERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuilhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6ql7K8 IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl- bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT 1CCM4eWrFnIrNVe3JDx3a0gicvjVtRQpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhil0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000. https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9 uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPf N~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7Ml88QkIqNTK1BqjBK8YeysAPbrNDAC ytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nho74m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX- DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-

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Claim Element	Example Infringement Evidence
	sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4 WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIV BR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQ xD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J3 9C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2 G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0FqgXFZTeKO 3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk 2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtw Vnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF- gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39 QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT8W ~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CW xRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41F mvaEMv8NErO3ANuCG1aLlkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yK A45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYN WXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXv11kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~Fm cQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VD volOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibm BRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above.

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Claim Element	Example Infringement Evidence
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; see also RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").
	Indeed, to adapt playback between different bitrate Variant Streams, the End User Device "can use the EXTINF durations and the constraints in Section 6.2.4 to determine the approximate location of corresponding media. Once media from the new Variant Stream has been loaded, the timestamps in the Media Segments can be used to synchronize the old and new timelines precisely." RFC 8216 at 47.
	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").

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Claim Element	Example Infringement Evidence				
	version of switches to determines and receive the higher receives th	the streamlets. Upon a detection request and receive the 3 sthat the 500000 Bandwidth 1800000 Bandwidth vers	vice accessing Kidoodle.TV request termination that the higher bitrate cate 600000 Bandwidth version of the streamlets can be a version of the streamlets. Then, the sion of the streamlets can be supported that is a version of the streamlets. Below is an able status of the requests.	nnot leamle suppo End lead, an	be supported, the End User Device ets. The End User Device then orted, and subsequently requests User Device then determines that ad subsequently requests and
	Method	Host	Path		Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete

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Claim Element		Example Infringement Evidence					
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete		
	The Kidoodle "[p]laylist files contain URIs, which clients will use to make network requests of arbitrary entities." RFC 8216 at 55. When playback starts on the video player, "[t]he client," which is the video player, "SHALL choose which Media Segment to play first from the Media Playlist." RFC 8216 at 45; <i>id.</i> at 47 ("The first segment to load is generally the segment that the client has chosen to play first (see Section 6.3.3)."). Then, "[i]n order to play the presentation normally, the next Media Segment" the video player requests and "load[s] the one with the lowest Media Sequence Number that is greater than the Media Sequence Number of the last Media Segment loaded." RFC 8216 at 47. That is, to playback normally, the video player must request a plurality of files with sequential Media Sequence Numbers/timestamps and the requests are made based on the Media Sequence Numbers/timestamps.						
	As shown above, although the End User Device accessing Kidoodle.TV requests the <b>1800000 Bandwidth</b> version of the program, it quickly switches to requesting the <b>300000 Bandwidth</b> , then <b>500000 Bandwidth</b> , the back to the <b>1800000 Bandwidth</b> version when bandwidth is adjusted. Those requests, as shown above, are "Completed," meaning the streamlets were received from the one or more Kidoodle servers.  On information and belief, playlists for the other resolution variants also include these segments, which correspond to the same portion of the video provided from the server(s).						
[11.8] receive the requested first	The End User Device accessing Kidoodle.TV receives the requested first streamlet from the at least one server via the one or more network connections.						
streamlet from the at least one server via the one or	uninterrup	ted playback at the best pos	itrate of the media to the current nessible quality." RFC 8216 at 4; see addington a server for concurrent productions.	also i	d. ("Using this protocol, a client		

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Claim Element		Example Infringement Evidence					
more network connections; and	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.						
	Method	Host	Path		Status		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete		

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Claim Element			Example Infringement Evidence	e	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete
[11 Ol provide the	RFC 8216 Kidoodle. Tat 47 ("The 6.3.3)."). Trequests ar Number of Device mu are made but As shown version of back to the "Complete"	at 55. When playback stars TV, "SHALL choose which e first segment to load is go Then, "[i]n order to play the ad "load[s] the one with the fithe last Media Segment loast request a plurality of file based on the Media Sequent above, although the End Uthe program, it quickly sweet 1800000 Bandwidth versed," meaning the streamlets	ser Device accessing Kidoodle.TV itches to requesting the <b>300000 Bar</b> ion when bandwidth is adjusted. The were received from the one or more	" whi the M has ch edia S hat is playb Numb reque dwid nose re	ch is the video player accessing ledia Playlist." RFC 8216 at 45; it nosen to play first (see Section Segment" the End User Device greater than the Media Sequence ack normally, the End User bers/timestamps and the requests ests the 1800000 Bandwidth lth, then 500000 Bandwidth, ther equests, as shown above, are loodle servers.
[11.9] provide the received first streamlet for output of the digital content to a presentation device.	In response accessing I connection	the video player embedded e to requesting the first stre Kidoodle.TV receives the r as. See e.g., RFC 8216 at 4	odle.TV provides the received first in the Kidoodle.TV site.  camlet via an HTTP GET request, a requested streamlet from the server ("Using this protocol, a client can retion."); <i>id.</i> at 5 ("To play this Playli	s shov via th eceiv	wn above, the End User Device e one or more network e a continuous stream of media

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Claim Element			Example Infringement Evidence	e		
	downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments.").					
	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bar</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently rea and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determine the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests a receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequentlisting showing the same alongside the status of the requests.					
	Method	Host	Path	•••	Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete	

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## U.S. Patent No. 11,677,798 to Kidoodle

Claim Element		Example Infringement Evidence					
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete		
	on the Kie users may	doodle support webpage, <u>b</u>	ayer provides video playback to end <a href="https://about.kidoodle.tv/faq/">https://about.kidoodle.tv/faq/</a> . There, acts users on how to optimize their vi	Kidoo	odle troubleshoots problems		

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## U.S. Patent No. 11,677,798 to Kidoodle

Claim Element	Example Infringement Evidence
	Why isn't Kidoodle.TV® working?
	We have worked hard to create a service that can be accessed across as many devices as possible, but as with all technology there are times when it may not work properly. There are a number of reasons why this can happen including simple connectivity issues to more complex ones. If you're experiencing any issues, please try the following:  1. Confirm that you are connected to a WIFI network and that the connection is strong.  2. Close the app and re-launch it.  3. Sign out of your account (if you have one) and log back in.  4. Check to see if there is a recent update, and if so, update the app.
	5. Delete the app from your device and re-install it.
	If the problem persists, please contact us and we would be more than happy to try and find a solution.
	When sending us a message, please take note of any error codes you may see, and provide as much detailed information as possible, including the device you're streaming on.
	Does Kidoodle.TV® work while I'm offline?  Unfortunately, Kidoodle.TV is a streaming service and as such you must be connected to a WIFI network or use data to watch.

# **EXHIBIT P**

#### U.S. Patent No. 9,407,564 to Kidoodle

The following claim chart shows exemplary aspects of A Parent Media Co. Inc.'s Kidoodle.TV streaming services and products ("Kidoodle") that infringe claim 1 of the '564 Patent. The chart is exemplary and should not be read to limit DISH's assertions against Kidoodle, or any other streaming services offered by A Parent Media Co. Inc. or Kidoodle as to the services or products described below. The chart should not be read to limit DISH's assertions to the patent claim charted below. Nor should the chart below be read to limit how Kidoodle infringes the claim below.

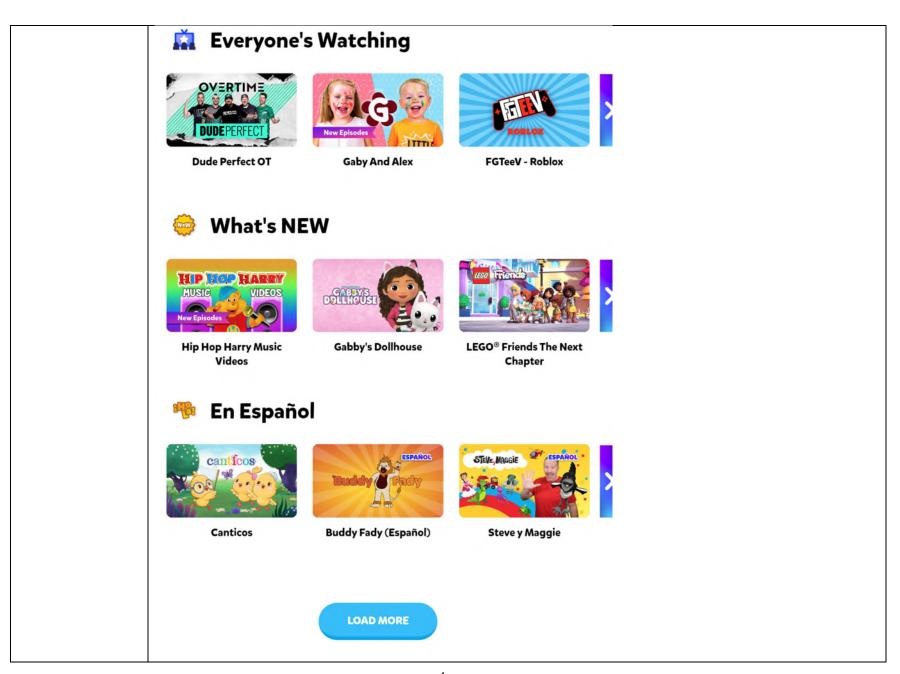
Claim Element		<b>Example Infringement Evidence</b>				
[1.pre] An end user station for adaptive-rate content streaming	Kidoodle includes information and Applications that include an end user station for adaptive-rate content streaming of digital content from a video server over a network. Kidoodle is executable by devices that obtain streams of a selected video program for playback. The streams include live streams that are obtained from or more servers affiliated with Kidoodle over a network.					
of digital content from a video server over a network, the end user station comprising:	The images in this chart are from a device accessing the Kidoodle.tv website through a web browser, such a Microsoft Edge, Google Chrome, or iOS Safari. Kidoodle.tv supports all major web browsers. <i>See</i> https://about.kidoodle.tv/ ("We're available across all available platforms.").					
	Curated Content	Parental Controls	Easy-to-Watch			
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes, curfews, analytics,</b> and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.			
	https://about.kidoodle.tv/ ("We're av	ailable across all available platforms.'	")			

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Claim Element	Example Infringement Evidence
	Kidoodle also includes applications for all platforms, including Apple App Store for iOS devices, Google Play for Android devices, Roku, and Amazon Fire TV, which also access the Kidoodle.tv website to stream video content. See <a href="https://about.kidoodle.tv/watch-now/">https://about.kidoodle.tv/watch-now/</a>
	KiDoodleth
	Download our App!
	Download on the App Store Google Play Roku Available on the Channel Store WATCH ON amazon fireTV
	https://about.kidoodle.tv/watch-now/
	Upon information and belief, the aforementioned device that accesses Kidoodle.tv through a website, and the applications that access Kidoodle.tv (collectively, "End User Device") operate in the same or substantially the same way for purposes of this chart.

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Example Infringement Evidence			
The one or more servers accessible by Kidoodle store video files which are streamed to the end user stations.			
The following are examples of the videos that may be streamed from the one or more servers to the End User			
Device(s). See <a href="https://kidoodle.tv/">https://kidoodle.tv/</a> .			



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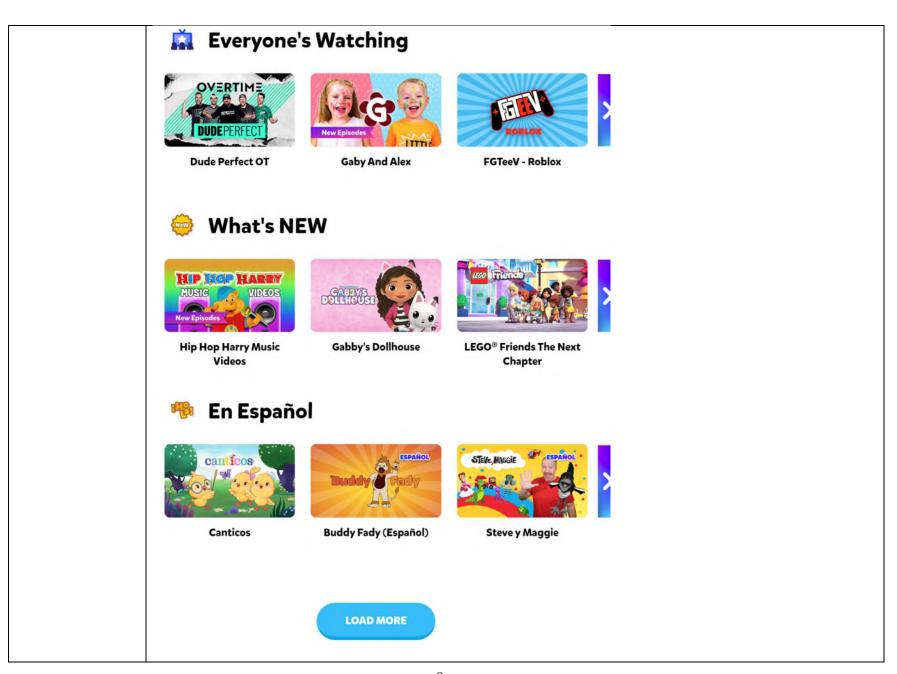
Claim Element	Example Infringement Evidence					
	https://kidoodle.tv/.					
	Tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the media player embedded in the Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.					
	Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.					
	With respect to adaptively receiving the digital stream from the video server over the network, the media player embedded in the Kidoodle.TV site accesses adaptive bitrate streams are provided to the media player from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.					
[1.1] a media	The End User Device accessing Kidoodle.TV includes a media player operating on the end user station					
player operating on the end user	configured to stream a video from the video server via at least one transmission control protocol (TCP) connection over the network. HLS uses HTTP, which operates via TCP connections over the network.					
station configured to stream a video from the video server via at least	As explained above, tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view					

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Claim Element	Example Infringement Evidence				
one transmission control protocol (TCP) connection over the network,	the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the media player embedded in the Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.				
	Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.				
	With respect to adaptively receiving the digital stream from the video server over the network, the media player embedded in the Kidoodle.TV site accesses adaptive bitrate streams are provided to the media player from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.				
	Through the established network connection, the devices streaming Kidoodle access video programs that are stored on one or more servers for display on the devices via the video player accessing the Kidoodle.TV site. <i>See</i>				

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Claim Element	Example Infringement Evidence					
	also					
	_	Parental Controls  Be the best parent, even when you're not there. Bedtimes, curfews, analytics, and more features are available to all users.  e available across all available platfor a Kidoodle store video files which are				
	-	deos that may be streamed from the one				



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Claim Element	Example Infringement Evidence				
	https://kidoodle.tv/.				
[1.2] wherein multiple different copies of the video encoded at different bit rates are stored on the video server as multiple sets of files,	The one or more servers accessible by the End User Device store multiple different copies of the video encoded at different bit rates are stored on the video server as multiple sets of files.  For example, in the instant test of a video titled "Dude Perfect," the end user station: established a network connection, connected with the one or more servers, and the End User Device made an HTTP GET request to prod.kidoodle.tv for a master manifest located at the following path:  https://prod.kidoodle.tv/api/2.0/content/elemental-source/web/2545/94152/670158/watch/manifest.m3u8 (hereafter referred to as the "Master Manifest" or "manifest.m3u8"). The Master Manifest returned the following contents, reflecting the Uniform Resource Indicators ("URIs") of the various variant playlists hosting				
mes,	at least a group of streamlets:  #EXTM3U				
	#EXT-X-VERSION:3				
	#EXT-X-STREAM-INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"				
	8.m3u8				
	#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"				
	7.m3u8				
	#EXT-X-STREAM-INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"				
	6.m3u8				

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Claim Element	Example Infringement Evidence						
	#EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2" 5.m3u8						
	File path: manifest.m3u8						
	The master playli	st shows four versions of the video stream at the following bandwidths:					
	<ul> <li>1800000 (</li> <li>500000 (r</li> <li>800000 (r</li> </ul> For each of these selected video pro	referred to herein as "300000 Bandwidth") having a resolution of 480x270 referred to herein as "1800000 Bandwidth") having a resolution of 1280x720 referred to herein as "500000 Bandwidth") having a resolution of 480x270 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 480x270 referred to herein as "800000 Bandwidth") having a resolution of 480x270 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406					
	Bandwidth	Bandwidth Token <sup>1</sup>					
	300000 8.m3u8? Bandwidth						
	1800000 Bandwidth						

<sup>&</sup>lt;sup>1</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence				
	500000 Bandwidth	6.m3u8?				
	800000 Bandwidth	5.m3u8?				
	Each of the bandwidth streams includes segments that encode the same portion of the video at various qualities. For example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>500000 or 800000 Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000 Bandwidth</b> version can be considered a high-quality stream.					
		er Device also uses HTT ied in the file above.	PS GET requests to retriev	e the seg	ments, or streamlets, of the encod	led
	The Media Playlist for each of the Variant Streams identifies a group of streamlets associated with each of the different copies, as the exemplary Media Playlist shown below illustrates. <i>See</i> RFC 8216 at 38 ("The server must create a Media Playlist file (Section 4) that contains a URI for each Media Segment that the server wishes to make available, in the order in which they are to be played."); <i>see also</i> RFC 8216 at 4 ("A multimedia presentation is specified by a Uniform Resource Identifier (URI) [RFC3986] to a Playlist."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation. A Media Segment is specified by a URI and optionally a byte range.").					er vishes t 4 ("A
	As shown by the Charles Proxy application file, partially reproduced below, the streamlet video files are hosted on a server accessible via https://vcdm-cf.kidoodle.tv/. The server accesses the stored streamlet files for playback on an end user device.					
	Method	Host	Path <sup>2</sup>	•••	Status	

<sup>&</sup>lt;sup>2</sup> Video path abbreviated for readability throughout.

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Claim Element	Example Infringement Evidence					
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 0.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 1.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 2.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 3.ts?		Complete	
	As shown of the stre	s.  in the test data, the End U	User Device accessing Kido	odle.TV	perform the demonstrated claim selects the <b>1800000 Bandwidth</b> verver(s) returns the playlist file with	
	#H	EXTM3U				
	#H	EXT-X-VERSION:3				
	#I	EXT-X-TARGETDURAT	TON:11			
	#I	EXT-X-MEDIA-SEQUEN	NCE:0			
	#H	EXTINF:10.750000,				

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Claim Element	Example Infringement Evidence	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude0.ts?Expires=1692058230&Signat ure=X-j9VAHmYvweCM- dblOesIErSUUPPye19SnCx9oSQaIPIQ9PYd9fEqw70kunQdE0c9VdJUJT05ewHTOHxwr0fXs g1UCjh2MBBBXuSguMBNLDplNuJxeg9ZzZpeEfPNC~k- GWyC79vUAs1SasIIG1VfVy89Kb7cBiHt17- baaBU01zty90WpmmejGY~vYOoen7gdJ9v7M~z0lVVREBiyygE7A0vGww6pEpEMztwSZZ4 ZoBkCdhZmLe3vjUm5MMr8nrU8n~ljj6fEYV3GeQiNlSEAApGW1qa5cNtQOhfX2ClzKrGHx paXUKqEheDRGyCs2u3bOEHjqRm2o1-ynSK5rFw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.250000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude1.ts?Expires=1692058230&Signat ure=CDpwAf98XhRNKYFrCcv- ofhY3VrgZ6T7M~dt8AXR4VRuOrMTiwDrlCQfZ01vbPEmfi~L0OK6K9Y6rlItw3hSboVNYc- Bs8Kxtaqz~kiDoN3TvSHmiaPcpjGO03IQ5nLbwn- gcptixhXoqmhAYSfFJ8q1NrOHvq5WzlOKvx8v10snMl1mxS0fC5VRDXEYbkCvLSqe8OBa8 kev2TqT8dZw7uFepqygtWzr5C0u- 6nWGZHqw4vC0d~N50BQSxQ5bjMz28sAs1vw2KmnoYx4exlNb1EE6M6nUPCA3C9dc5tei7 fB4UUZDjALiy3x7tOF3Zd2KJg6yxsNQC3ER8sD8g98SQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.083333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=1692058230&Signat ure=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBd gfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-	

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Claim Element	Example Infringement Evidence	
	NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signat ure=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVa HEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLf DUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.416667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signat ure=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=1692058230&Signat ure=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53RunAwQ~p3j4P6	

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Claim Element	Example Infringement Evidence	
	3FEfL-ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZpKD6UQPz8JI4 OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signat ure=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFd SviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0 wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1 b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75YdM91BCDnFgTaB2DGh w9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signat ure=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oPERBiu3cpkU1bmx18V7z1k BeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkF xOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAO GTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=1692058230&Signat ure=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8IS2H2uktgoA	

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Claim Element	Example Infringement Evidence
	vqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT1CCM4eWrFn IrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2- y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=1692058230&Signat ure=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9uG1gv6uaDU F-NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDACytArwL9~CtJ qifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw- rtvvpM2YO35x3QnHMYJlpNjIg-vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX- DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB 0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW 4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692058230&Signa

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Claim Element	Example Infringement Evidence
	ture=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J39C0TOfHfhkuWX3GNV~B 7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk 6YyHaHA~YwMvSqF0FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692058230&Signa ture=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk2w0HmAaV5 pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B- rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692058230&Signa ture=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39QN0fozRAJiDpxwfbGRLiCs cRoibOsDnp8g45-N1Dv- l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45U nLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKO etZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLlkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692058230&Signa ture=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yKA45ce57fGCLQkOTs9rLwvG KYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4l Jq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VDvolOXbtWeRISpeUtqRcyPv IEGMQsBtgT2E2IfmnXKJIPyRTR1~rR8gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.458333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude15.ts?Expires=1692058230&Signa ture=EmKhQ97V1kC2nux03LOh0AsSs8x3T5uYyPU7uQwFWokFiT5Z1lXPDOYuvT4gX8H2 9x5ZwaGw9fzRPXaevWiB-ZyaBTwKdD5sNiXzC85OSWOECID- V1OWE4FK0zsvdbK5AhvJ3UvtNzufrrcBM9deA1B0PD8NLxZ9at3GlebQlcoyuvMPmcogOD 7uPWbGcRUMw~kfl6JvTlQDcqbh7Azckr8Pj85rDKpY7ffr3dNqHK45HTx4Hq8P6BJ5HsI7 xXzimlgev1OuXSYnXwUib-ejbAqhnf- VcwgEuwFi2u9imp45LbHP~4ChIHJ2y5zkOvk6Vd6Rhlwe5QE~-91Ya7OA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude16.ts?Expires=1692058230&Signa ture=D9tydyyfLvc63w423qjALtY-u7peL5T09eMLvlf3qIhCt- z8xRmbnXtpHEtXxwqI~tQqCssOLXwaC-EY- 2o2wPfVMWWMVFw1vyi~T~DBrixO4J9gdgCnN7XiGrI8EbePchv5-H7e- ReOIuUWsSOryzM6xfIOIM1KN- dlXCqfCpIXnyOZOwsnVFAgxZcekcLrarB8e8SpE1wobXIogjk2DGMr3GmYymTXsGFiODw XBTMuhWRcV1TARZLMK69oozNgv6-Te97KflduUeZVt6zapVj-	

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Claim Element	Example Infringement Evidence
	6Q8ZK7x7J9EFxmFwPXe7~SFFUQTxFMNJcu0esokmKOAR2tCxznBheaUR1Gag&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-CUE-OUT: 0
	#EXT-X-CUE-IN
	#EXTINF:8.375000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude17.ts?Expires=1692058230&Signa ture=G0-13akiy1zABYLlQcnx7Om3pfZaPh~26uL9-jwDy9bwyV6KOSVTJ9uknM13xLq12pki6n6V0cWIDrQvpsvz2Tl8~ewAUkjzwesP-1XnJuY9tolEBNTaipdcKKeCNLw8LB9El~9einSOyMxcXmzX7ieVVlu-A~wi2GwbcMUb-w8OlvYZjVa9yTxzoz2TUjkHqFmJQ6NJ4rrnmzIsAyFu75W71LOHC-J1vs0dbN-S581jzsrg6WtUI9CbxM59TmAdLLJfnKS7XAgU5a0u~0ZbPF5Ne4z3xFWkif4joJCRc8E991A R18BUoyFCth3z8vJDd-uDp5M-br~nKEfRI5ZvBg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	The variant playlist file is an HLS playlist. Each line in the file path "361/670158/7/hls/S0E4_WorldsStrongestDude17.ts" that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the variant playlist shown above, the segments of the video are separated by commercial segments. Each of the streamlets (except the first and final streamlets of each playlist) is approximately 8-10 seconds long and returns sequential segments of the video program and/or commercial.
	As long as the viewer continues watching the video and the bandwidth is adequate to support the chosen resolution, the end user device will continue to request (and Kidoodle.TV will provide) streamlets corresponding to the current, chosen resolution.

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Claim Element		Example Infringement Evidence	
	On information and belief, the of files.	other bandwidth versions of the test video contain the same number of streamlet	
[1.3] wherein each of the files yields a different portion of the video on playback,	the video encoded at different be of the files yields a different port. Each of the Media Segments in provides that "[e]ach segment in Sequence Number of the first set 4.3.3.2). The Media Sequence Negment that precedes it plus on continuation of the encoded bits where values in a series such as at 6. Thus, each of the streamlet	more servers accessible by the End User Device store multiple different copies of it rates are stored on the video server as multiple sets of files. Additionally, each rtion of the video on playback.  HLS yields a different portion of the video on playback. For example, HLS is a Media Playlist has a unique integer Media Sequence Number. The Media regment in the Media Playlist is either 0 or declared in the Playlist (Section Number of every other segment is equal to the Media Sequence Number of the ite." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the iteram from the end of the segment with the previous Media Sequence Number, timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 is in a set must yield a different portion of the video on playback.	
	For example, the <b>300000 Bandy Bandwidth</b> version can be constant considered a high-quality stream	width version can be considered a low-quality stream, the 500000 or 800000 sidered a medium-quality stream, and the 1800000 Bandwidth version can be	
	or streamlets, that encode segme	ents of the video program. The streamlet files within each version playlist are gical order, beginning with the first segment of the video program and	
	Bandwidth	Streamlet (segment)	
	500000 Bandwidth	#EXTM3U	
		#EXT-X-VERSION:3	

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Claim Element	Example Infringement Evidence
	#EXT-X-TARGETDURATION:11
	#EXT-X-MEDIA-SEQUENCE:0
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst-

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Claim Element	Example Infringement Evidence
	smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- L14ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:9.916667,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV	
	Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude <b>7</b> .ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp	
	4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169	

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Claim Element	Example Infringement Evidence	
	2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjClSg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9 ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3slh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG- AuKqOtVCEx0UHFHJJJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-	
	vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.666667,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf	

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Claim Element	Example Infringement Evidence
	00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH-RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-0EsdN7ZUOam4P-E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6-Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp-E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t-ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.666667, 

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Claim Element		Example Infringement Evidence
		#EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ

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Claim Element	Example Infringement Evidence
	6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude <mark>5</mark> .ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL-
	ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
Claim Element	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXIS 2~10PERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA
	&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39

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Claim Element	Example Infringement Evidence
	KMI-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT

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Claim Element	Example Infringement Evidence
	8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.  Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams

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Claim Element	Example Infringement Evidence
	are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle. TV to synchronize the media. <i>Id.</i> Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.  The streamlets across the different copies yield the same portions of the video on playback. As set forth above,
	each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to

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Claim Element		Example Infringement Evidence
		witch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST on playback. RFC 8216 at 43.
[1.4] wherein the files across the different copies yield the same portions of the video on playback, and	As described above, the one or more servers accessible by the End User Device store multiple different copies of the video encoded at different bit rates are stored on the video server as multiple sets of files and each of the files yields a different portion of the video on playback. Additionally, the files across the different copies yield the same portions of the video on playback.  The master playlist shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270  • 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720  • 500000 (referred to herein as "500000 Bandwidth") having a resolution of 720x406  For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:	
	Bandwidth Token <sup>3</sup>	
	300000 Bandwidth	8.m3u8?

<sup>&</sup>lt;sup>3</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence	
	<b>1800000</b> 7.m <b>Bandwidth</b>	n3u8?	
	500000 6.m Bandwidth	n3u8?	
	800000 5.m Bandwidth	n3u8?	
	For example, the 300000 Bandwidth version can considered a high-qualit. As shown below, each or streamlets, that encode arranged in ascending changed.	ch of the bandwidth streams includes segments that encode the same portion of the video at various qualities. The example, the 300000 Bandwidth version can be considered a low-quality stream, the 500000 or 800000 andwidth version can be considered a medium-quality stream, and the 1800000 Bandwidth version can be asidered a high-quality stream.  Shown below, each of the 500000 Bandwidth and 1800000 Bandwidth version playlists contain segments, streamlets, that encode segments of the video program. The streamlet files within each version playlist are larged in ascending chronological order, beginning with the first segment of the video program and agressing until the final segment of the video program.	
	Bandwidth	Streamlet (segment)	
	500000 Bandwidth	#EXTM3U	
		#EXT-X-VERSION:3	
		#EXT-X-TARGETDURATION:11	
		#EXT-X-MEDIA-SEQUENCE:0	
		#EXTINF:10.083333,	

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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence	
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Claim Element		Example Infringement Evidence
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence	
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-	

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Claim Element	Example Infringement Evidence
	ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc-
	9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR-naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw_& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.
	Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle.TV to synchronize the media. <i>Id</i> . Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize

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Claim Element	Example Infringement Evidence
	Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
[1.5] wherein each of the files comprises a time index such that the	As described above, the one or more servers accessible by the End User Device store multiple different copies of the video encoded at different bit rates are stored on the video server as multiple sets of files, each of the files yields a different portion of the video on playback, and the files across the different copies yield the same portions of the video on playback. Additionally, each of the files comprises a time index such that the files

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Claim Element	Example Infringement Evidence
files whose playback is the	whose playback is the same portion of the video for each of the different copies have the same time index in relation to the beginning of the video.
same portion of the video for each of the different copies have the same time index in relation to the beginning of the video, and	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
	In the instant test, a personal computer accessing the Kidoodle.TV site through a web browser makes a HTTPS GET request to <b>prod.kidoodle.tv</b> for the Master Manifest. As shown in the excerpts of the Master Manifest below, the video available is encoded at 4 different bitrates.
	#EXTM3U #EXT-X-VERSION:3
	#EXT-X-STREAM- INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	8.m3u8

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Claim Element	Example Infringement Evidence	
	#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"	
	7.m3u8	
	#EXT-X-STREAM-INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"	
	6.m3u8	
	#EXT-X-STREAM-INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"	
	5.m3u8	
	File path: manifest.m3u8	
	The master playlist shows four versions of the video stream at the following bandwidths:	
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>	
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:	

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Claim Element	Example Infringement Evidence		
	Bandwidth	Token <sup>4</sup>	
	300000 Bandwidth	8.m3u8?	
	1800000 Bandwidth	7.m3u8?	
	500000 Bandwidth	6.m3u8?	
	800000 Bandwidth	5.m3u8?	
	For example, the 3	00000 Band n can be cons	includes segments that encode the same portion of the video at various qualities.  width version can be considered a low-quality stream, the 500000 or 800000  idered a medium-quality stream, and the 1800000 Bandwidth version can be  n.
	or streamlets, that arranged in ascend	encode segme ling chronolog	0000 Bandwidth and 1800000 Bandwidth version playlists contain segments, ents of the video program. The streamlet files within each version playlist are gical order, beginning with the first segment of the video program and ent of the video program.
	Bandwidth		Streamlet (segment)
	500000 Bandwid	lth	#EXTM3U

<sup>&</sup>lt;sup>4</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence
	#EXT-X-VERSION:3
	#EXT-X-TARGETDURATION:11
	#EXT-X-MEDIA-SEQUENCE:0
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca-
	5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg_ _&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v

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Claim Element	Example Infringement Evidence
	Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL
	sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJID6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV
	Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude <b>7</b> .ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp
	4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169

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Claim Element	Example Infringement Evidence
	2058315&Signature=BXa7FwbB-XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d-NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k-d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq-o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3slh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG- AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c- vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf

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Claim Element	Example Infringement Evidence
	00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s
	CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.333333,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 il~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.6666667,

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Claim Element		Example Infringement Evidence
		#EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVI- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ

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Claim Element	Example Infringement Evidence
	6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P11cK9CSOlduuqbA3h80LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL-
	ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
Claim Element	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-	
	Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXIS 2~10PERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA	
	&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39	

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Claim Element	Example Infringement Evidence	
	KMI-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	

# Case 1:23-cv-01000-GBW Document 1-1 Filed 09/08/23 Page 425 of 863 PageID #: 479

Claim Element	Example Infringement Evidence	
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT	

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8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&
Key-Pair-Id=APKAIPJESLAK2PMGD4PA
#EXTINF:10.333333,
https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9-xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryl5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB-y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
#EXT-X-ENDLIST
on information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle. TV (such as live videos) provide the same limitations.  ach of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant
2

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Claim Element	Example Infringement Evidence
	are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle.TV to synchronize the media. <i>Id</i> . Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.

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Claim Element	Example Infringement Evidence	
[1.6] wherein the media player streams the video by: requesting a plurality of sequential files of one of the copies from the video server based on the time indexes;	The media player on the Kidoodle.TV site using the End User Device streams the video by requesting a plurality of sequential files of one of the copies from the video server based on the time indexes.  The variant playlists file are HLS playlists. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV requests and retrieves the segments of the encoded stream specified in the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> , and each streamlet (except the first and final streamlets) is approximately 8-10 seconds long.  The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same	
	segmented moments in the	video.
	Bandwidth Version	File line (#EXTINF: length) (portion of live stream)
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,

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Claim Element	Example Infringement Evidence	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-ERIBXKGkK~- uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMvfBl YgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb- 4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg& Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
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Claim Element	Example Infringement Evidence	
	mam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~LwMBsQ XOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYWoEX kJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2Bj9g &Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58315&Signature=CM-bcy4GkvIZLwyvQ-oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2ww J4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-Ll4ZQKe13SeDvD0M~woH-vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PY WZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU 4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ318tv jSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwLCE WqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeBLQ 9oQeeUI3NiT97-	

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Claim Element	Example Infringement Evidence
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9HhQp rIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33XEVC ubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3zvOOO m6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn604UoStbeC RxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
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Claim Element	Example Infringement Evidence	
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM8Rhb F9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvcoG m-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P-	

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Claim Element	Example Infringement Evidence			
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28K9 4BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAxMXU8 Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVCgt Qgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3sCeV vdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			

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Claim Element	Example Infringement Evidence			
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		#EXT-X-VERSION:3		
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		#EXT-X-MEDIA-SEQUENCE:0		
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		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGK		

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Claim Element	Example Infringement Evidence
	UkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
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	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ- zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1s Xw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence			
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	#EXTINF:9.916667,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRw Wgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa 985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJ AnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R 0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75 YdM91BCDnFgTaB2DGhw9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
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Claim Element	Example Infringement Evidence			
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Claim Element	Example Infringement Evidence			
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	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:9.916667,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J3 9C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2 G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0FqgXFZTeKO 3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:9.500000,			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk			

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Claim Element	Example Infringement Evidence			
	2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtw Vnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF- gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA &Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:9.916667,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39 QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEj13Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.333333,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yK A45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYN WXti2HX96KWLRLluN9-xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~Fm cQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VD volOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibm BRqlyB-			

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Claim Element	Example Infringement Evidence			
	y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXT-X-ENDLIST			
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above.			
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; <i>see also</i> RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").			
	Indeed, to adapt playback between different bitrate Variant Streams, the End User Device accessing Kidoodle.TV "can use the EXTINF durations and the constraints in Section 6.2.4 to determine the approximate location of corresponding media. Once media from the new Variant Stream has been loaded, the timestamps in the Media Segments can be used to synchronize the old and new timelines precisely." RFC 8216 at 47.			
	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media			

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Claim Element		Example Infringement Evidence				
	Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.					
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").  For the instant test, the End User Device accessing Kidoodle.TV requests and receives the 1800000 Bandwidth version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the 300000 Bandwidth version of the streamlets. The End User Device then determines that the 500000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 500000 Bandwidth version of the streamlets. Then, the End User Device then determines that the higher 1800000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.					
				ce		
	Method	Host	Path	•••	Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete	

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Claim Element			Example Infringement Evidence	ee	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete
er "g fir "[ th M pl M	The Kidoodle "[p]laylist files contain URIs, which clients will use to make network requests of arbitrary entities." RFC 8216 at 55. When playback starts on the video player, "[t]he client," which is the video player, "SHALL choose which Media Segment to play first from the Media Playlist." RFC 8216 at 45; <i>id.</i> at 47 ("The first segment to load is generally the segment that the client has chosen to play first (see Section 6.3.3)."). Then, "[i]n order to play the presentation normally, the next Media Segment" the video player requests and "load[s] the one with the lowest Media Sequence Number that is greater than the Media Sequence Number of the last Media Segment loaded." RFC 8216 at 47. That is, to playback normally, the video player must request a plurality of files with sequential Media Sequence Numbers/timestamps and the requests are made based on the Media Sequence Numbers/timestamps.  As shown above, although the End User Device accessing Kidoodle.TV requests the 1800000 Bandwidth version of the program, it quickly switches to requesting the 300000 Bandwidth, then 500000 Bandwidth, then back to the 1800000 Bandwidth version when bandwidth is adjusted. Those requests, as shown above, are "Completed," meaning the streamlets were received from the one or more Kidoodle servers.				

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Claim Element	Example Infringement Evidence			
	On information and belief, playlists for the other resolution variants also include these segments, which correspond to the same portion of the video provided from the server(s).			
[1.7] automatically requesting from the video server subsequent portions of the video by requesting for each such portion one of the files from one of the copies dependent upon successive determinations by the media player to shift the playback quality to a higher or lower quality one of the different copies,	The End User Device automatically requests from the video server subsequent portions of the video by requesting for each such portion one of the files from one of the copies dependent upon successive determinations by the media player to shift the playback quality to a higher or lower quality one of the different copies.  Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the media player accessing Kidoodle. TV to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.  As shown below, each of the 500000 Bandwidth and 1800000 Bandwidth version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program and progressing until the final segment of the video program. As noted above, the variant playlist file is an HLS playlist. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle. TV uses HTTPS GET requests to request			
	the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> .  The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-			

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Claim Element	Example Infringement Evidence						
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same segmented moments in the video.						
	Bandwidth	Bandwidth File line (#EXTINF: length) (portion of live stream)					
	500000 Bandwidth	#EXTM3U					
		#EXT-X-VERSION:3					
		#EXT-X-TARGETDURATION:11					
		#EXT-X-MEDIA-SEQUENCE:0					
		#EXTINF:10.083333,					
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333,					

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Claim Element	Example Infringement Evidence						
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169						

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Claim Element	Example Infringement Evidence					
	oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.916667,					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvIIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.500000,					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp - 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-					

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Claim Element	Example Infringement Evidence					
	UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA#EXTINF:9.750000,					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG-					

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Claim Element	Example Infringement Evidence						
	AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:10.666667,						
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn-cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf 00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.916667,						
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.500000,						

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Claim Element	Example Infringement Evidence					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjql9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGo6Q3kMzCK1z~5nkZlytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0ly8uRq- qVVkpglZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dlgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6h1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8la-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXiINNDZ6gUYag0c3kvKAqgmRMPf- 9725wj0FmW31px87wtOFOP1REVaGflwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBflCuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtlW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333.					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to					

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Claim Element	Example Infringement Evidence					
		ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.666667,				
	1800000 Bandwidth	#EXT-X-ENDLIST #EXTM3U				
		#EXT-X-VERSION:3  #EXT-X-TARGETDURATION:11  #EXT-X-MEDIA-SEQUENCE:0				
		#EXTINF:10.083333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-				

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Claim Element	Example Infringement Evidence					
	CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.333333,					
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ 6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.416667,					
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6					
	x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.125000,					
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169					

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Claim Element	Example Infringement Evidence						
	2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS 2~10PERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-						

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Claim Element	Example Infringement Evidence					
	kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA &Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.750000,					
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA-QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39 KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.125000,					
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					

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Claim Element	Example Infringement Evidence						
	#EXTINF:10.666667,						
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.916667,						
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.500000,						
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-						

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Claim Element	Example Infringement Evidence					
	ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.916667,					
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw_& Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.333333,					
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~					
	FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB-y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					

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Claim Element	Example Infringement Evidence					
			#EXT-X-ENDLIST			
	uninterrupt can received. The End U streamlets. request and the 500000 Ba 1800000 B 1800000 B	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").  The End User Device accessing Kidoodle.TV requests and receives the 1800000 Bandwidth version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the 300000 Bandwidth version of the streamlets. The End User Device then determines that the 500000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.				
	Method	Host	Path		Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete	

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Claim Element	Example Infringement Evidence						
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete		
	uninterru	pted playback at the best p	bitrate of the media to the current ne ossible quality." RFC 8216 at 4; see a media from a server for concurrent pro-	also i	d. ("Using this protocol, a client		
	_	ned above, the master play cam at the following bandw	vlist for the instant test video—"Dude vidths:	e Perf	ect"—shows four versions of the		
	• 18 • 50	800000 (referred to herein as 00000 (referred to herein as	s "300000 Bandwidth") having a restant "1800000 Bandwidth") having a restant "500000 Bandwidth") having a restant "800000 Bandwidth") having a restant "800000 Bandwidth") having a restant "900000 Bandwidth"	resolu solutio	ntion of 1280x720 on of 480x270		
	selected v		er playlist provides a link to a playlis ar bandwidth and resolution. Each ve For example:		*		

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Claim Element		Example Infringement Evidence					
	Bandwidth	Token <sup>5</sup>					
	300000 Bandwidth	8.m3u8?					
	1800000 Bandwidth	7.m3u8?					
	500000 Bandwidth	6.m3u8?					
	800000 Bandwidth	5.m3u8?					
[1.8] the automatically requesting including repeatedly generating a factor indicative of the current ability to sustain the streaming of the video using the files from different ones of the copies,	the video by request determinations by the copies. Additionally ability to sustain the one or more factors bandwidth.  HLS "allows a receive uninterrupted playbe can receive a continual description."  As explained above	the End User Device automatically requests from the video server subsequent portions of ting for each such portion one of the files from one of the copies dependent upon successive the media player to shift the playback quality to a higher or lower quality one of the different by, the automatic request includes, repeatedly generating a factor indicative of the current the streaming of the video using the files from different ones of the copies, wherein the set of the relate to the performance of the network, such as network conditions and/or available diver to adapt the bitrate of the media to the current network conditions in order to maintain back at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client muous stream of media from a server for concurrent presentation.").  The master playlist for the instant test video—"Dude Perfect"—shows four versions of the following bandwidths:					

<sup>&</sup>lt;sup>5</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence				
wherein the set of one or more factors relate to the performance of the network;						
	Bandwidth	Token <sup>6</sup>				
	300000 Bandwidth	8.m3u8?				
	1800000 Bandwidth	7.m3u8?				
	500000 Bandwidth	6.m3u8?				
	800000 Bandwidth	5.m3u8?				
	streamlets. Upon	vice accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the a determination that the higher bitrate cannot be supported, the End User Device switches to be the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that				

<sup>&</sup>lt;sup>6</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence						
	the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.						
	Method	Host	Path	•••	Status		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?	•••	Complete		

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Claim Element		Example Infringement Evidence					
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete		
	Additionally, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.						
[1.9] making the successive determinations to shift the playback quality based on the factor to achieve continuous	The End User Device makes the successive determinations to shift the playback quality based on the factor to achieve continuous playback of the video using the files of the highest quality one of the copies determined sustainable at that time so that the media player upshifts to a higher quality one of the different copies when the factor is greater than a first threshold and downshifts to a lower quality one of the different copies when the factor is less than a second threshold.  HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client						
playback of the video using the files of the highest quality one of the copies determined	can receive a continuous stream of media from a server for concurrent presentation.").  As explained above, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270						
sustainable at that time so that the media player upshifts to a higher quality one of the different copies	• 180 • 500	00000 (referred to herein as 0000 (referred to herein as "	"1800000 Bandwidth") having a res '500000 Bandwidth") having a res '800000 Bandwidth") having a res	resolu solutio	ntion of 1280x720 on of 480x270		

Claim Element		Example Infringement Evidence					
when the factor is greater than a first threshold and	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:						
downshifts to a lower quality one	Bandwidth	Token <sup>7</sup>					
of the different copies when the factor is less than a	300000 Bandwidth	8.m3u8?					
second threshold;	1800000 Bandwidth	7.m3u8?					
	500000 Bandwidth	6.m3u8?					
	800000 Bandwidth	5.m3u8?					
	streamlets. Upon request and receive the 500000 Bandwid 500000 Bandwid 1800000 Bandwid	vice accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the a determination that the higher bitrate cannot be supported, the End User Device switches to be the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that width version of the streamlets can be supported, and subsequently requests and receives the the version of the streamlets. Then, the End User Device then determines that the higher dth version of the streamlets can be supported, and subsequently requests and receives the dth version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing let the status of the requests.					

<sup>&</sup>lt;sup>7</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element			Example Infringement Evidence	e	
	Method	Host	Path	•••	Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete

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Claim Element		Example Infringement Evidence							
	timestamps	s within the media to syncatching content in Variant	umber. The Discontinuity Sequence hronize Media Segments across diff Streams MUST have matching Dis	erent	Renditions." RFC 8216 at 39.				
[1.10] presenting the video by		The End User Device presents the video by playing back the requested media files with the media player on the end user station in order of ascending playback time.							
playing back the requested media files with the media player on the end user station in order of ascending playback time.									
	Method	Host	Path	•••	Status				
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?	•••	Complete				

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Claim Element			Example Infringement Evidence	ee	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete
	on the Kie users may	doodle support webpage, <u>b</u>	ayer provides video playback to end uttps://about.kidoodle.tv/faq/. There, its users on how to optimize their vi	Kidoo	odle troubleshoots problems end

Claim Element	Example Infringement Evidence						
	Why isn't Kidoodle.TV® working?						
	We have worked hard to create a service that can be accessed across as many devices as possible, but as with all technology there are times when it may not work properly. There are a number of reasons why this can happen including simple connectivity issues to more complex ones. If you're experiencing any issues, please try the following:  1. Confirm that you are connected to a WIFI network and that the connection is strong.  2. Close the app and re-launch it.  3. Sign out of your account (if you have one) and log back in.  4. Check to see if there is a recent update, and if so, update the app.  5. Delete the app from your device and re-install it.						
	If the problem persists, please contact us and we would be more than happy to try and find a solution.  When sending us a message, please take note of any error codes you may see, and provide as much detailed information as possible, including the device you're streaming on.						
	Does Kidoodle.TV® work while I'm offline?  Unfortunately, Kidoodle.TV is a streaming service and as such you must be connected to a WIFI network or use data to watch.						

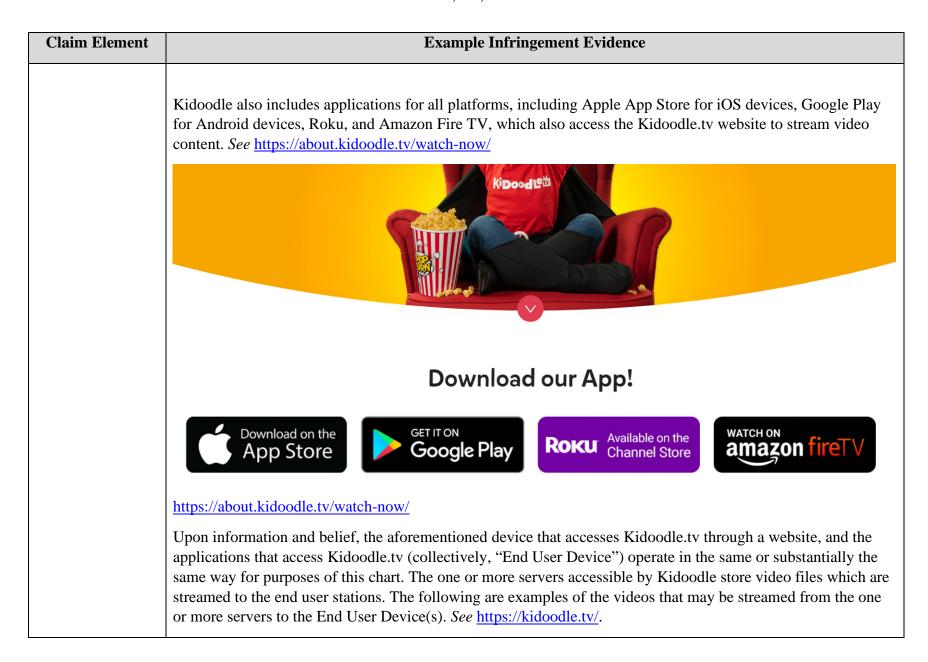
# EXHIBIT Q

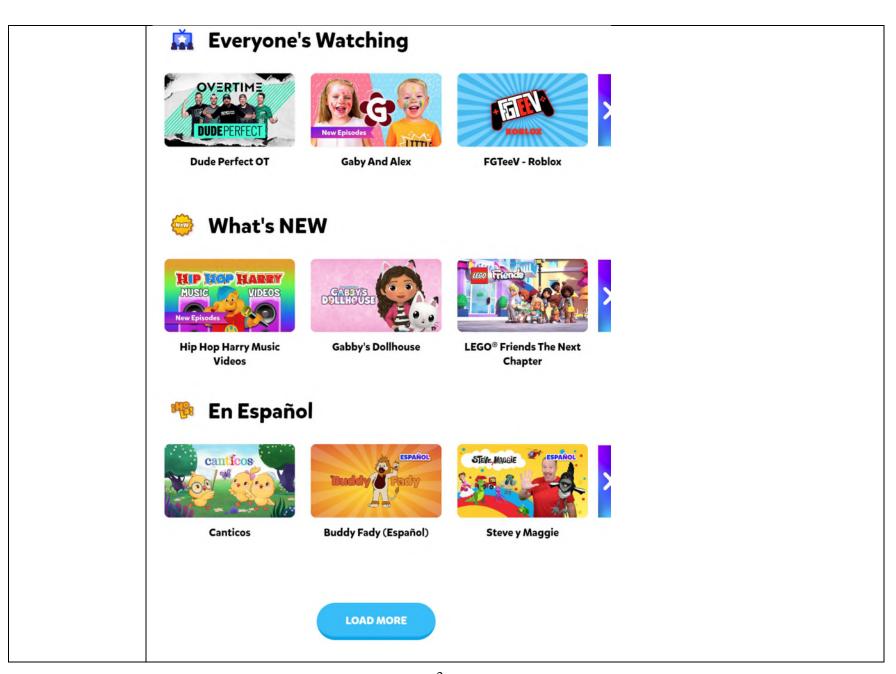
#### **U.S. Patent No. 10,951,680 to Kidoodle**

The following claim chart shows exemplary aspects of A Parent Media Co. Inc.'s Kidoodle.TV streaming services and products ("Kidoodle") that infringe claim 14 of the '680 Patent. The chart is exemplary and should not be read to limit DISH's assertions against Kidoodle, or any other streaming services offered by A Parent Media Co. Inc. or Kidoodle as to the services or products described below. The chart should not be read to limit DISH's assertions to the patent claim charted below. Nor should the chart below be read to limit how Kidoodle infringes the claim below.

Claim Element		<b>Example Infringement Evidence</b>	
[14.pre] An end user station to stream a video over a network from a server for playback of the video, the content player device comprising:	network from a server for playback o selected video program for playback. servers affiliated with Kidoodle over to stream a video for playback by one The images in this chart are from a de Microsoft Edge, Google Chrome, or in	pplications that includes an end user start the video. Kidoodle is executable by do The streams include live streams that a an etwork. Kidoodle performs a process or more end user stations.  Evice accessing the Kidoodle.tv website OS Safari. Kidoodle.tv supports all magnitude across all available platforms."	levices that obtain streams of a re obtained from one or more s executable by one or more servers through a web browser, such as jor web browsers. <i>See</i>
	Curated Content	Parental Controls	Easy-to-Watch
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes</b> , <b>curfews</b> , <b>analytics</b> , and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
	https://about.kidoodle.tv/ ("We're ava	ailable across all available platforms."	)

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Claim Element	Example Infringement Evidence
	https://kidoodle.tv/.  Tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the media player embedded in the Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.
	Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.  With respect to adaptively receiving the digital stream from the video server over the network, the media player embedded in the Kidoodle.TV site accesses adaptive bitrate streams are provided to the End User Device from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.
[14.1] a processor;	Kidoodle's content is accessible on End User Devices. https://about.kidoodle.tv/ ("We're available across <b>all available platforms</b> ."). Example end user devices include personal computers, Macintosh computers, Apple iPhones, Apple iPads, Android phones, Android tablets, and smart TV devices equipped to access the internet via one or more network connections. The end users' devices include a processor configured to enable video streaming.

Claim Element	Example Infringement Evidence		
	Curated Content	Parental Controls	Easy-to-Watch
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes, curfews, analytics,</b> and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
	See https://about.kidoodle.tv/ ("We're	e available across <b>all available platfor</b>	ms.")
		idoodle website are from accessing the formation and belief, at least one of the processor.	**
[14.2] a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed,	personal computers, Macintosh comp smart TV devices equipped to access include a processor configured to ena having non-transitory machine-readal	ent is accessible on end users' devices. Juters, Apple iPhones, Apple iPads, And the internet via one or more network couble video streaming. The end users' de tole instructions that cause an end user of user station and the server, wherein the reamlets.	droid phones, Android tablets, and onnections. The end users' devices vices also include memory devices device to establish one or more

Claim Element	Example Infringement Evidence		
cause the processor to: establish one or more network connections		nection, the devices streaming Kidoodle lay on the devices via the video player	1 0
between the end user station and the server, wherein the server is			
configured to	Curated Content	Parental Controls	Easy-to-Watch
access at least one of a plurality of groups of streamlets;	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes</b> , <b>curfews</b> , <b>analytics</b> , and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
	See https://about.kidoodle.tv/ ("We're	e available across all available platfor	rms.")
	segments of a video program, and eac streams, or variant playlists, comprise	oodle.TV video programs store streamler of streamlet is encoded at one of numers a plurality of streamlets at the same playback of the streams at a resolution	rous resolutions. Each of the stored resolution. The arrangements of each
	connection, connected with the one or <b>prod.kidoodle.tv</b> for a master manife	~ ·	HTTP GET request to
		tent/elemental-source/web/2545/941 Manifest" or "manifest.m3u8"). The	

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Claim Element	Example Infringement Evidence
	following contents, reflecting the Uniform Resource Indicators ("URIs") of the various variant playlists hosting at least a group of streamlets:
	#EXTM3U
	#EXT-X-VERSION:3
	#EXT-X-STREAM-INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	8.m3u8
	#EXT-X-STREAM-INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"
	7.m3u8
	#EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	6.m3u8
	#EXT-X-STREAM-INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"
	5.m3u8
	File path: manifest.m3u8
	The master playlist shows four versions of the video stream at the following bandwidths:
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>

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Claim Element	Example Infringement Evidence		
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each variant playlist, or version playlist, is defined by the token associated with the stream file path. For example:		
	Bandwidth	Token <sup>1</sup>	
	300000 Bandwidth	8.m3u8?	
	1800000 Bandwidth	7.m3u8?	
	500000 Bandwidth	6.m3u8?	
	800000 Bandwidth	5.m3u8?	
	various qualities. <b>500000 or 80000</b>	ant playlists includes segments, or streamlets, that encode the same portion of the video at a For example, the 300000 Bandwidth version can be considered a low-quality stream, the 30 Bandwidth version can be considered a medium-quality stream, and the 1800000 ion can be considered a high-quality stream.	

<sup>&</sup>lt;sup>1</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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laim Element	Example Infringement Evidence					
			quests to retrieve the segme ore servers hosting Kidoodle		reamlets, of the encoded video spe	ecified
	different comust create to make as presentation Media Play specified by As shown on a server	opies, as the exemplary Me a Media Playlist file (Sovailable, in the order in won is specified by a Uniforylist contains a series of May a URI and optionally a by the Charles Proxy app	Media Playlist shown below ection 4) that contains a UR hich they are to be played." It makes that make the state of the s	illustrate I for each ); see als I) [RFC3 up the ov	streamlets associated with each of es. See RFC 8216 at 38 ("The server of Media Segment that the server were RFC 8216 at 4 ("A multimedia 1986] to a Playlist."); RFC 8216 at erall presentation. A Media Segment that the streamlet video files are helpesses the stored streamlet files for	er vishes 4 ("A ent is
	Method	Host	Path <sup>2</sup>		Status	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 0.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 1.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 2.ts?		Complete	

<sup>&</sup>lt;sup>2</sup> Video path abbreviated for readability throughout.

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Claim Element		Example Infringement Evidence			
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 3.ts?		Complete
	information resolution such that the As shown	on and belief, the live even s, hosted on one or more s they similarly perform the in the test data, Kidoodle	t videos offered to Kidoodlervers, and accessed throug demonstrated claim limitatelects the 1800000 Bandy	e viewer gh HTTP ions. vidth ver	s hosting Kidoodle content. On s are similarly encoded at multiple Get Requests by end users' devices, rsion of the stream and makes a request st file with the following contents:
	#E #E #E htt cf. ure db g1 GV ba Zc	e=X-j9VAHmYvweCM- lOesIErSUUPPye19SnCx UCjh2MBBBXuSguMBN WyC79vUAs1SasIIG1VfV aBU01zty90WpmmejGY~ BkCdhZmLe3vjUm5MM	CE:0 /hls/S0E4_WorldsStronges 9oSQaIPIQ9PYd9fEqw70k ILDplNuJxeg9ZzZpeEfPNo 7y89Kb7cBiHt17- ~vYOoen7gdJ9v7M~z0lVV	kunQdE0 C~k- /REBiyy /ISEAAp	s?Expires=1692058230&Signat c9VdJUJT05ewHTOHxwr0fXs gE7A0vGww6pEpEMztwSZZ4 GW1qa5cNtQOhfX2ClzKrGHx

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Claim Element	Example Infringement Evidence
	#EXTINF:9.250000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude1.ts?Expires=1692058230&Signat ure=CDpwAf98XhRNKYFrCcv- ofhY3VrgZ6T7M~dt8AXR4VRuOrMTiwDrlCQfZ01vbPEmfi~L0OK6K9Y6rlItw3hSboVNYc- Bs8Kxtaqz~kiDoN3TvSHmiaPcpjGO03IQ5nLbwn- gcptixhXoqmhAYSfFJ8q1NrOHvq5WzlOKvx8v10snMl1mxS0fC5VRDXEYbkCvLSqe8OBa8 kev2TqT8dZw7uFepqygtWzr5C0u- 6nWGZHqw4vC0d~N50BQSxQ5bjMz28sAs1vw2KmnoYx4exlNb1EE6M6nUPCA3C9dc5tei7 fB4UUZDjALiy3x7tOF3Zd2KJg6yxsNQC3ER8sD8g98SQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.083333,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=1692058230&Signat ure=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBd gfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok-0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signat ure=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVa HEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLf DUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-

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Claim Element	Example Infringement Evidence
	eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57- ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw &Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signat ure=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=1692058230&Signat ure=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53RunAwQ~p3j4P6 3FEfL-ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4ahEG-et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZpKD6UQPz8JI4 OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signat ure=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb-

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Claim Element	Example Infringement Evidence
	p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1 b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75YdM91BCDnFgTaB2DGh w9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signat ure=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oPERBiu3cpkU1bmx18V7z1k BeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=1692058230&Signat ure=BA-QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8IS2H2uktgoA vqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT1CCM4eWrFn IrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=1692058230&Signat ure=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA-

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Claim Element	Example Infringement Evidence
	P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9uG1gv6uaDU F-NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPfN~kJVa94-XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg-vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692058230&Signa ture=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J39C0TOfHfhkuWX3GNV~B 7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk 6YyHaHA~YwMvSqF0FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692058230&Signa

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Claim Element	Example Infringement Evidence
	ture=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk2w0HmAaV5 pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B- rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667, https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692058230&Signa ture=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39QN0fozRAJiDpxwfbGRLiCs cRoibOsDnp8g45-N1Dv-12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45U nLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKO etZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLlkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692058230&Signa ture=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yKA45ce57fGCLQkOTs9rLwvG KYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4l Jq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VDvolOXbtWeRISpeUtqRcyPv lEGMQsBtgT2E2IfmnXKJIPyRTR1~rR8gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:9.458333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude15.ts?Expires=1692058230&Signa ture=EmKhQ97V1kC2nux03LOh0AsSs8x3T5uYyPU7uQwFWokFiT5Z11XPDOYuvT4gX8H2 9x5ZwaGw9fzRPXaevWiB-ZyaBTwKdD5sNiXzC85OSWOECID- V1OWE4FK0zsvdbK5AhvJ3UvtNzufrrcBM9deA1B0PD8NLxZ9at3GlebQlcoyuvMPmcogOD 7uPWbGcRUMw~kfl6JvTlQDcqbh7Azckr8Pj85rDKpY7ffr3dNqHK45HTx4Hq8P6BJ5HsI7 xXzimlgev1OuXSYnXwUib-ejbAqhnf- VcwgEuwFi2u9imp45LbHP~4ChIHJ2y5zkOvk6Vd6Rhlwe5QE~-91Ya7OA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude16.ts?Expires=1692058230&Signa ture=D9tydyyfLvc63w423qjALtY-u7peL5T09eMLvlf3qIhCt- z8xRmbnXtpHEtXxwqI~tQqCssOLXwaC-EY- 2o2wPfVMWWMVFw1vyi~T~DBrixO4J9gdgCnN7XiGrI8EbePchv5-H7e- ReOIuUWsSOryzM6xfIOIM1KN- dlXCqfCpIXnyOZOwsnVFAgxZcekcLrarB8e8SpE1wobXIogjk2DGMr3GmYymTXsGFiODw XBTMuhWRcV1TARZLMK69oozNgv6-Te97KflduUeZVt6zapVj- 6Q8ZK7x7J9EFxmFwPXe7~SFFUQTxFMNJcu0esokmKOAR2tCxznBheaUR1Gag&Key- Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXT-X-CUE-OUT: 0 #EXT-X-CUE-IN #EXTINF:8.375000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude17.ts?Expires=1692058230&Signa ture=G0-13akiy1zABYLlQcnx7Om3pfZaPh~26uL9- jwDy9bwyV6KOSVTJ9uknM13xLq12pki6n6V0cWIDrQvpsvz2Tl8~ewAUkjzwesP-	

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Claim Element	Example Infringement Evidence
	1XnJuY9tolEBNTaipdcKKeCNLw8LB9El~9einSOyMxcXmzX7ieVVlu-A~wi2GwbcMUb-w8OlvYZjVa9yTxzoz2TUjkHqFmJQ6NJ4rrnmzIsAyFu75W71LOHC-J1vs0dbN-S581jzsrg6WtUI9CbxM59TmAdLLJfnKS7XAgU5a0u~0ZbPF5Ne4z3xFWkif4joJCRc8E991ARl8BUoyFCth3z8vJDd-uDp5M-br~nKEfRI5ZvBg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	The variant playlist file is an HLS playlist. Each line in the file path "361/670158/7/hls/S0E4_WorldsStrongestDude17.ts" that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the variant playlist shown above, the segments of the video are separated by commercial segments. Each of the streamlets (except the first and final streamlets of each playlist) is approximately 8-10 seconds long and returns sequential segments of the video program and/or commercial.  As long as the viewer continues watching the video and the bandwidth is adequate to support the chosen resolution, the end user device will continue to request (and Kidoodle.TV will provide) streamlets corresponding to the current, chosen resolution.
[14.3] wherein the video is encoded at a plurality of different bitrates to create a plurality of streams	As mentioned above, Kidoodle videos are encoded at a plurality of different bitrates to create a plurality of streams including at least a low quality stream, a medium quality stream, and a high quality stream, each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded at the same respective one of the different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the videos.
including at least a low quality stream, a medium quality stream, stream, and a high	In the instant test, a personal computer accessing the Kidoodle.TV site through a web browser makes a HTTPS GET request to <b>prod.kidoodle.tv</b> for the Master Manifest of a video program titled "Dude Perfect." As shown in the excerpts of the Master Manifest below, the video available is encoded at 4 different bitrates.

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Claim Element	Example Infringement Evidence	
quality stream, each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded at the same respective one of the different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a	#EXT-X-VERSION:3 #EXT-X-STREAM- INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2" 8.m3u8 #EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2" 7.m3u8 #EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2" 6.m3u8 #EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2" 5.m3u8	
portion of the video;	File path: manifest.m3u8  The master playlist shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270  • 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720  • 500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270  • 800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406	

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Claim Element		Example Infringement Evidence
	selected video pro	versions, the master playlist provides a link to a playlist for the specified version of the ogram at a particular bandwidth and resolution. Each version playlist is defined by the token he stream file path. For example:
	Bandwidth	Token <sup>3</sup>
	300000 Bandwidth	8.m3u8?
	1800000 Bandwidth	7.m3u8?
	500000 Bandwidth	6.m3u8?
	800000 Bandwidth	5.m3u8?
	For example, the	width streams includes segments that encode the same portion of the video at various qualities. 300000 Bandwidth version can be considered a low-quality stream, the 500000 or 800000 on can be considered a medium-quality stream, and the 1800000 Bandwidth version can be quality stream.
		each of the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> version playlists contain segments, encode segments of the video program. The streamlet files within each version playlist are

<sup>&</sup>lt;sup>3</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence
		nological order, beginning with the first segment of the video program, and egment of the video program.
	Bandwidth	Streamlet (segment)
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.3333333,
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude <mark>3</mark> .ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU

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Claim Element	Example Infringement Evidence
	QQQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr-KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYlFq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxl3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ-
	oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH-

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Example Infringement Evidence
vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12IL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
#EXTINF:9.916667,
https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp - 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1- UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaB Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf- 1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-

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Claim Element	Example Infringement Evidence
	xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058315&Signature=BXa7FwbB-XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d-NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k-d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq-o2dQKyTvcEFrc2g _ &Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3slh3PwsEJPGn-IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO-V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG-AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,

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Claim Element	Example Infringement Evidence
Claim Element	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf 00wm8ZG6nml5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQttLIHObwbaJ yml8sALw_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAlh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig
	yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-

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Claim Element	Example Infringement Evidence
	qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-

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#EXT-X-ENDLIST #EXTM3U
#EXTM3U
#EXTM3U
#EXT-X-VERSION:3
#EXT-X-TARGETDURATION:11
#EXT-X-MEDIA-SEQUENCE:0
#EXTINF:10.083333,
https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVI- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ 6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57- ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-

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Claim Element	Example Infringement Evidence
	eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS 2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
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	gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA-
	P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-

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Claim Element	Example Infringement Evidence
	ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu116 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
Claim Element	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-
	ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.333333,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude 14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXv11kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp
	m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXT-X-ENDLIST

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Claim Element	Example Infringement Evidence
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.
	Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle. TV to synchronize the media. <i>Id.</i> Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number,

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Claim Element	Example Infringement Evidence
	where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
[14.4] wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded	As explained above, Kidoodle videos are encoded at a plurality of different bitrates to create a plurality of streams including at least low, medium, and high quality streams. Each of the low, medium, and high quality streams has a streamlet that encodes the same portion of the video at a different one of the plurality of different bitrates. Each of the streamlets comprising the low, medium, and high, quality streams are stored in variant playlists comprising a group of streamlets of the same quality at a respective bit rate. At least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps.
at a bit rate of no less than 600 kbps;	File path: manifest.m3u8
and	The master playlist shows four versions of the video stream at the following bandwidths:
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>
[14.5] wherein the	The first streamlets of each of the low quality stream, the medium quality stream and the high quality stream
first streamlets of each of the low	each has an equal playback duration and each of the first streamlets encodes the same portion of the video at a different one of the different bitrates.
quality stream, the medium quality	As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at

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Claim Element		Example Infringement Evidence
stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes the same portion of the video at a different one of the different bitrates;	Stream MUST present the same content in Variant Streams MUS media. <i>Id.</i> Further, "[e]ach Med The Discontinuity Sequence Nu Media Segments across different MUST have matching Discontinuity As shown below, each of the <b>50</b> or streamlets, that encode segments arranged in ascending chronology progressing until the final segment playlist. Each line in the file that line below the #EXTINF file is Kidoodle.TV uses HTTPS GET the file above. The video files at streamlets) is approximately 8-1. The received playlists at each recf.kidoodle.tv//[X]/hls/S0E4_cf.kidoodle.tv/	esolution includes video streamlets, such as: "https://vcdm-WorldsStrongestDude2.ts," "https://vcdm-WorldsStrongestDude3.ts," "https://vcdm-WorldsStrongestDude4.ts," "https://vcdm-WorldsStrongestDude5.ts," and "https://vcdm-WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each a bandwidth playlist file, there are the 17 .ts files, each corresponding to the same
	500000 Bandwidth	#EXTM3U

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Claim Element	Example Infringement Evidence
	#EXT-X-VERSION:3
	#EXT-X-TARGETDURATION:11
	#EXT-X-MEDIA-SEQUENCE:0
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.3333333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v

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Claim Element	Example Infringement Evidence
	Sst-smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ-oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-Ll4ZQKe13SeDvD0M~woH-vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PYWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:9.916667,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp	
	4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAuxPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169	

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Claim Element	Example Infringement Evidence				
	2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG- AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c- vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.666667,				
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf				

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Claim Element	Example Infringement Evidence				
	00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAlh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				

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Claim Element	Example Infringement Evidence				
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wt0FOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.333333,				
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.666667, 				

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Claim Element	Example Infringement Evidence				
		#EXT-X-ENDLIST			
	1800000 Bandwidth	#EXTM3U			
		#EXT-X-VERSION:3			
		#EXT-X-TARGETDURATION:11			
		#EXT-X-MEDIA-SEQUENCE:0			
		#EXTINF:10.083333,			
		https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok-0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
		#EXTINF:10.333333,			
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ			

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Claim Element	Example Infringement Evidence				
	6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA#EXTINF:10.416667,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				

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Claim Element	Example Infringement Evidence				
	#EXTINF:9.916667,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS 2~10PERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.750000,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39				

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Claim Element	Example Infringement Evidence				
	KMI-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				

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Claim Element	Example Infringement Evidence				
	#EXTINF:9.916667,				
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRIRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.916667,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT				

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Claim Element	Example Infringement Evidence					
	8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXv11kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA					
	#EXT-X-ENDLIST					
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above. Similarly, on information and belief, the other bandwidth version streamlets are the same durations as the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> versions.					
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media					

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Claim Element	Example Infringement Evidence
	Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; <i>see also</i> RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").
[14.6] select a specific one of the low quality stream,	The End User Device selects a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams.
the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams;	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").
	As explained above, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the video stream at the following bandwidths:
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:

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Claim Element	Example Infringement Evidence					
	Bandwidth	Token <sup>4</sup>				
	300000	8.m3u8?				
	Bandwidth					
	1800000	7.m3u8?				
	Bandwidth					
	500000	6.m3u8?				
	Bandwidth					
	800000	5.m3u8?				
	Bandwidth					
	streamlets. Upon request and rece the 500000 Bandwi 500000 Bandwi 1800000 Bandwi 1800000 Bandwi	vice accessing Kidoodle.TV re a determination that the higher we the <b>300000 Bandwidth</b> version of the streamlets. The dth version of the streamlets could be determined by the streamlets of the streamlets. It is the status of the requests. Path	bitrate cannot be supported on of the streamlets. The can be supported, and supported, the End User Device on be supported, and subset of the supported.	ed, the End then eque	ne End User Device switches. User Device then determine quently requests and receives determines that the higher ently requests and receives the	s to es that s the
	Method Hos	Path		•••	Status	

<sup>&</sup>lt;sup>4</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence						
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete		
	allow Kid	loodle to synchronize the r r Discontinuity Sequence N	n]atching content in Variant Streams nedia. RFC 8216 at 43. And "[e]ach Number. The Discontinuity Sequence chronize Media Segments across diff	Medi Num	a Segment in a Media Playlist has aber can be used in addition to the		

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Claim Element		Example Infringement Evidence
	Thus, "[m]atching content in 8216 at 43.	n Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC
[14.7] place at least one virtual timeline request for at least one virtual times based on the selected one of the low quality stream, the medium quality stream, and the high quality stream; and`	The End User Device places at least one virtual timeline request for at least one virtual times based on the selected one of the low quality stream, the medium quality stream, and the high quality stream.  The variant playlists file are HLS playlists. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV requests and retrieves the segments of the encoded stream specified in the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> , and each streamlet (except the first and final streamlets) is approximately 8-10 seconds long.  The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same segmented moments in the video.	
	Bandwidth Version	File line (#EXTINF: length) (portion of live stream)
	500000 Bandwidth	#EXTM3U  #EXT-X-VERSION:3  #EXT-X-TARGETDURATION:11  #EXT-X-MEDIA-SEQUENCE:0

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Claim Element	Example Infringement Evidence
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-ERIBXKGkK~- uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMvfBl YgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb- 4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigUQOQg L~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr-KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLYAeE 62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~vSst-smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58315&Signature=YXXHRRu4Adc2jc-XdGykv-

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Claim Element	Example Infringement Evidence
	zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42qpY mam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~LwMBsQ XOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYWoEX kJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58315&Signature=CM-bcy4GkvIZLwyvQ-oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2ww J4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-L14ZQKe13SeDvD0M~woH-vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PY WZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU 4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ3I8tv jSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwLCE WqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeBLQ

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Claim Element	Example Infringement Evidence
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn-IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsad7 BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO-V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp2vf 5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrcZyVY Sd2~kXj3CG-AuKqOtVCEx0UHFHJjX~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39nk9it xzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DVPqjXH1d cm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf00w m8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35dQoPsu 4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJyml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM8Rhb F9BSiM5ETvGlSfVMmUjlAlh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvcoG m-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-

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Claim Element	Example Infringement Evidence
	0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7igyLj hGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaGZkvaB ObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH15~o QepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqCky3EV~g yOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-qVVkpgIZkF1HrUvTWvHcEXkVv-tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5EfbGv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4-jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987-4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28K9 4BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAxMXU8 Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVCgt Qgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3sCeV vdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element		Example Infringement Evidence
		#EXTINF:10.333333,
		https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6toED9s TTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6-Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2iI~i jh7cbzmcgb38F-mazr0uLY-Rp-E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqaCeE 0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t-ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:9.666667,
		#EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGK

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Claim Element	Example Infringement Evidence
	UkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYH XS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25D xDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80Lz LrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ- zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1s Xw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58230&Signature=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN- fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53Ru nAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4 ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZp KD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRw Wgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa 985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJ AnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R 0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75 YdM91BCDnFgTaB2DGhw9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oP ERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-

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Claim Element	Example Infringement Evidence
	OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8 IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl- bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT 1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9 uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPf N~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDAC ytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-

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Claim Element	<b>Example Infringement Evidence</b>
	nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J3 9C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2 G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0FqgXFZTeKO 3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk

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Claim Element	Example Infringement Evidence
	2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtw Vnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF- gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA &Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39 QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEj13Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yK A45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYN WXti2HX96KWLRLluN9-xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~Fm cQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VD volOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibm BRqlyB-

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Claim Element	Example Infringement Evidence							
	y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA							
	#EXT-X-ENDLIST							
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above.							
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; <i>see also</i> RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").							
	Indeed, to adapt playback between different bitrate Variant Streams, the End User Device "can use the EXTINF durations and the constraints in Section 6.2.4 to determine the approximate location of corresponding media. Once media from the new Variant Stream has been loaded, the timestamps in the Media Segments can be used to synchronize the old and new timelines precisely." RFC 8216 at 47.							
	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media							

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Claim Element			<b>Example Infringement Evidence</b>	ee			
	Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.						
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").  For the instant test, the End User Device accessing Kidoodle.TV requests and receives the 1800000 Bandwidth version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the 300000 Bandwidth version of the streamlets. The End User Device then determines that the 500000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 500000 Bandwidth version of the streamlets. Then, the End User Device then determines that the higher 1800000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.						
	Method	Host	Path		Status		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete		

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete
	entities." "SHALL first segn "[i]n orde the one w Media Se plurality Media Se As shown version o back to th	RFC 8216 at 55. When place choose which Media Segrent to load is generally the er to play the presentation with the lowest Media Sequeration and the lowest Media Sequeration of files with sequential Media Sequence Numbers/timestament above, although the End of the program, it quickly some 1800000 Bandwidth versions.	in URIs, which clients will use to manyback starts on the video player, "[t] ment to play first from the Media Player segment that the client has chosen to hormally, the next Media Segment" the ence Number that is greater than the at 47. That is, to playback normally, dia Sequence Numbers/timestamps at a sequence Numbers/timestamps at a sequence Numbers to requesting the 300000 Barrision when bandwidth is adjusted. That is were received from the one or more	the claylist." o play he vio he vio the vio and the reque hose i	ient," which is the video player, 'RFC 8216 at 45; id. at 47 ("The y first (see Section 6.3.3)."). Then, deo player requests and "load[s] ia Sequence Number of the last video player must request a the requests are made based on the ests the 1800000 Bandwidth of th, then 500000 Bandwidth, then requests, as shown above, are

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Claim Element	Example Infringement Evidence					
	On information and belief, playlists for the other resolution variants also include these segments, which correspond to the same portion of the video provided from the server(s).					
[22.8] receive the	The End U	ser Device accessing Kide	oodle.TV receives the at least one vi	rtual 1	timeline.	
at least one virtual timeline.	uninterrupt	ted playback at the best po	bitrate of the media to the current ne ossible quality." RFC 8216 at 4; see nedia from a server for concurrent pr	also i	d. ("Using this protocol, a client	
	version of switches to determines and receive the higher receives th	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.				
	Method	Host	Path	•••	Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete	

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete
	RFC 821 Kidoodle at 47 ("Ti 6.3.3)."). requests a Number of Device mare made As shown version of back to the	6 at 55. When playback stated at 55. When play the first segment to load is grand "load[s] the one with the first Media Segment at 55 at 55 at 55. When the first playback at 55 at 55. When the first playback stated	RIs, which clients will use to make not arts on the video player, "[t]he client, and the Media Segment to play first from generally the segment that the client is the presentation normally, the next Mane lowest Media Sequence Number to loaded." RFC 8216 at 47. That is, to alles with sequential Media Sequence note Numbers/timestamps.  User Device accessing Kidoodle.TV witches to requesting the 300000 Barrision when bandwidth is adjusted. The term of the one or more than the sequence of the	" whi the M has ch edia S hat is playb Numb reque ndwice	ch is the video player accessing Media Playlist." RFC 8216 at 45; id. nosen to play first (see Section Segment" the End User Device greater than the Media Sequence back normally, the End User bers/timestamps and the requests ests the 1800000 Bandwidth ath, then 500000 Bandwidth, then requests, as shown above, are

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Claim Element	Example Infringement Evidence					
[22.9] retrieving from the storage device the requested virtual timeline for the currently selected one of the low quality stream, the medium quality stream, and the high quality stream; and	As described above, the one or more servers affiliated with Kidoodle retrieve from the storage device the requested virtual timeline for the currently selected one of the low quality stream, the medium quality stream, and the high quality stream.					
[22.10] sending the retrieved virtual timeline to the requesting one of the end user stations over the one or more network connections.	The one or more servers send the retrieved virtual timeline to the requesting one of the end user stations over the one or more network connections.  HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").  For the instant test, the End User Device accessing Kidoodle.TV requests and receives the 1800000 Bandwidth version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the 300000 Bandwidth version of the streamlets. The End User Device then determines that the 500000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 500000 Bandwidth version of the streamlets. Then, the End User Device then determines that the higher 1800000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.					
	Method Host Path Status					

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete
		-1 - 0	in URIs, which clients will use to ma		1 7
	"SHALL	choose which Media Segn	nyback starts on the video player, "[t] nent to play first from the Media Play e segment that the client has chosen t	ylist."	RFC 8216 at 45; <i>id.</i> at 47 ("The
	_	•	normally, the next Media Segment" t		

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Claim Element	Example Infringement Evidence
	the one with the lowest Media Sequence Number that is greater than the Media Sequence Number of the last Media Segment loaded." RFC 8216 at 47. That is, to playback normally, the video player must request a plurality of files with sequential Media Sequence Numbers/timestamps and the requests are made based on the Media Sequence Numbers/timestamps.
	As shown above, although the End User Device accessing Kidoodle.TV requests the <b>1800000 Bandwidth</b> version of the program, it quickly switches to requesting the <b>300000 Bandwidth</b> , then <b>500000 Bandwidth</b> , then back to the <b>1800000 Bandwidth</b> version when bandwidth is adjusted. Those requests, as shown above, are "Completed," meaning the streamlets were received from the one or more Kidoodle servers.

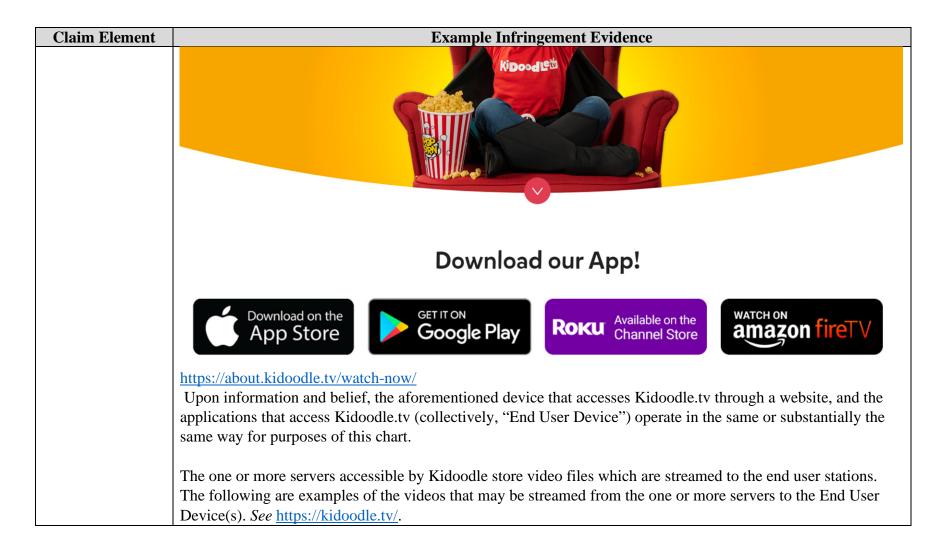
# EXHIBIT R

#### **U.S. Patent No. 10,469,555 to Kidoodle**

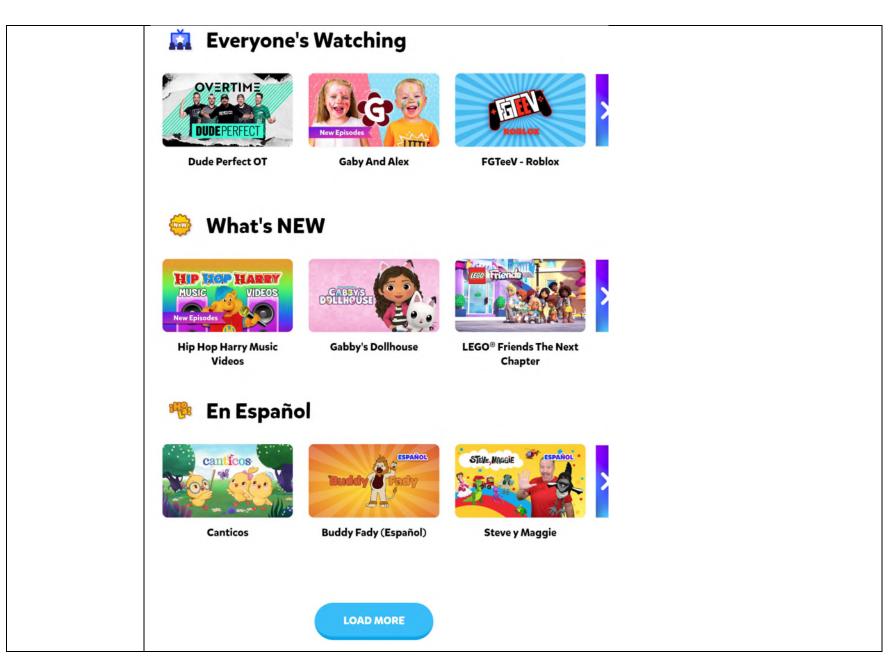
The following claim chart shows exemplary aspects of A Parent Media Co. Inc.'s Kidoodle.TV streaming services and products ("Kidoodle") that infringe claim 10 of the '555 Patent. The chart is exemplary and should not be read to limit DISH's assertions against Kidoodle, or any other streaming services offered by A Parent Media Co. Inc. or Kidoodle as to the services or products described below. The chart should not be read to limit DISH's assertions to the patent claim charted below. Nor should the chart below be read to limit how Kidoodle infringes the claim below.

Claim Element		<b>Example Infringement Evidence</b>				
[10.pre] A content	Kidoodle includes information and Applications that include an end user content player device which streams a					
player device to	video over a network from a server for	r playback of the video. Kidoodle is ex	ecutable by devices that obtain			
stream a video over a network	streams of a selected video program for	- ·	treams that are obtained from one or			
from a server for	more servers affiliated with Kidoodle	over a network.				
playback of the	The images in this chart are from a de	wise accessing the Videodle ty website	through a wah browser such as			
video, the content	Microsoft Edge, Google Chrome, or it					
player device comprising:	https://about.kidoodle.tv/ ("We're ava		~			
	Curated Content	Parental Controls	Easy-to-Watch			
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes</b> , <b>curfews</b> , <b>analytics</b> , and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.			
	https://about.kidoodle.tv/ ("We're avar	ilable across all available platforms."	<b>'</b> )			
	Kidoodle also includes applications fo		· · ·			
	for Android devices, Roku, and Amaz content. See					

#### U.S. Patent No. 10,469,555 to Kidoodle



#### **U.S. Patent No. 10,469,555 to Kidoodle**



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Claim Element	Example Infringement Evidence
	https://kidoodle.tv/.  Tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the media player embedded in the Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.  Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.  With respect to adaptively receiving the digital stream from the video server over the network, the media player embedded in the Kidoodle.TV site accesses adaptive bitrate streams are provided to the media player from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.
[10.1] a processor;	Kidoodle's content is accessible on End User Devices. https://about.kidoodle.tv/ ("We're available across all available platforms."). Example end user devices include personal computers, Macintosh computers, Apple iPhones, Apple iPads, Android phones, Android tablets, and smart TV devices equipped to access the internet via one or more network connections. The end users' devices include a processor configured to enable video streaming.

Claim Element		<b>Example Infringement Evidence</b>	
	Curated Content  No fancy algorithms here. Every show available on our service has been watched and screened by a real human being.	Parental Controls  Be the best parent, even when you're not there. Bedtimes, curfews, analytics, and more features are available to all users.	Easy-to-Watch  Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
[10.2] a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed, cause the processor to:  establish one or more network	The screenshots in this chart of the Ki iPhone or Windows computer. On inf viewing Kidoodle content contains a part As explained above, Kidoodle's content personal computers, Macintosh composmart TV devices equipped to access include a processor configured to enable having non-transitory machine-readal network connections between the End to access at least one of a plurality of Through the established network connections	ent is accessible on end users' devices.  uters, Apple iPhones, Apple iPads, An the internet via one or more network c ble video streaming. The end users' de ble instructions that cause an end user of User Device and the server hosting K	Example end user devices include adroid phones, Android tablets, and connections. The end users' devices evices also include memory devices device to establish one or more addoodle videos, which is configured the access video programs that are

Claim Element		<b>Example Infringement Evidence</b>	
module and the server, wherein the server is configured to access at least one of a plurality of groups of	also		
streamlets;	Curated Content  No fancy algorithms here. Every show available on our service has been watched and screened by a real human being.	Parental Controls  Be the best parent, even when you're not there. Bedtimes, curfews, analytics, and more features are available to all users.	Easy-to-Watch  Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
	See <a href="https://about.kidoodle.tv/">https://about.kidoodle.tv/</a> ("We're The one or more servers hosting Kidoo segments of a video program, and each streams, or variant playlists, comprises variant playlist ensure the sequential playlist ens	odle.TV video programs store streams a streamlet is encoded at one of numes a plurality of streamlets at the same layback of the streams at a resolution deo titled "Dude Perfect," the end use more Kidoodle servers, and made an at located at the following path:  ent/elemental-source/web/2545/941  Manifest" or "manifest.m3u8"). The form Resource Indicators ("URIs") of	lets corresponding to particular rous resolutions. Each of the stored resolution. The arrangements of each supported by the available network or station: established a network HTTP GET request to  52/670158/watch/manifest.m3u8  Master Manifest returned the the various variant playlists hosting

Claim Element	Example Infringement Evidence				
	8.m3u8				
	#EXT-X-STREAM-				
	INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"				
	7.m3u8				
	#EXT-X-STREAM	M-			
	INF:BANDWIDT	H=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"			
	6.m3u8				
	#EXT-X-STREAM	M-			
		H=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"			
	5.m3u8				
	File path: manifes				
	* *	shows four versions of the video stream at the following bandwidths:			
	,	erred to herein as "300000 Bandwidth") having a resolution of 480x270			
		ferred to herein as "1800000 Bandwidth") having a resolution of 1280x720			
	• 500000 (ref	erred to herein as "500000 Bandwidth") having a resolution of 480x270			
	• 800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406				
	For each of these ve	ersions, the master playlist provides a link to a playlist for the specified version of the			
		ram at a particular bandwidth and resolution. Each variant playlist, or version playlist, is			
	defined by the token associated with the stream file path. For example:				
	defined by the token abborded with the bacam the paul. For example.				
	Bandwidth Token <sup>1</sup>				
	300000	8.m3u8?			
	Bandwidth				
	1800000	7.m3u8?			
	Bandwidth				

<sup>&</sup>lt;sup>1</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence					
	500000	6.m3u8?	-			
	Bandwidt	th				
	800000	5.m3u8?				
	Bandwidt	th				
	Each of the various qua 500000 or Bandwidth Kidoodle a in the file a The Media different comust create to make avapresentation Media Play specified by As shown to a server playback or Method	e variant playlists include alities. For example, the 3 800000 Bandwidth version can be consider lso uses HTTPS GET received bove from the one or mo Playlist for each of the Vopies, as the exemplary Me a Media Playlist file (Seailable, in the order in what is specified by a Uniford list contains a series of Me and URI and optionally a by the Charles Proxy apparacessible via https://vcm.an end user device.	300000 Bandwidth version ion can be considered a me red a high-quality stream. Quests to retrieve the segme ore servers hosting Kidoodle. Variant Streams identifies a Media Playlist shown below rection 4) that contains a UR mich they are to be played." The Resource Identifier (UR Media Segments that make a byte range."). lication file, partially reproduction of the contains a UR make a contain the contains a UR media Segments that make a byte range.").	nts, or stree content. group of illustrate I for each I) [RFC3 up the over duced below the content of the conte	streamlets associated with each of ss. See RFC 8216 at 38 ("The server of Media Segment that the server with PRC 8216 at 4 ("A multimedia 986] to a Playlist."); RFC 8216 at erall presentation. A Media Segment with the streamlet video files are hosses the stored streamlet files for Status	cified  the er ishes  4 ("A ent is
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude	•••	Complete	
			0.ts?			
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4	•••	Complete	
			_WorldsStrongestDude 1.ts?			
			1.13:			

<sup>&</sup>lt;sup>2</sup> Video path abbreviated for readability throughout.

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 2.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 3.ts?		Complete
	information resolution such that it As shown of the stree following #E	on and belief, the live ever is, hosted on one or more is they similarly perform the in the test data, the End U am and makes a request for contents:  XTM3U XT-X-VERSION:3 XT-X-TARGETDURAT XT-X-MEDIA-SEQUEN XTINF:10.750000, ps://vcdm-kidoodle.tv/361/670158/7 e=X-j9VAHmYvweCM-lOesIErSUUPPye19SnCx UCjh2MBBBXuSguMBN WyC79vUAs1SasIIG1VfVaBU01zty90WpmmejGY-BkCdhZmLe3vjUm5MM	nt videos offered to Kidoodle servers, and accessed through demonstrated claim limitated. Jser Device accessing Kidoor the corresponding playlist ION:11 ICE:0  V/hls/S0E4_WorldsStronges  190SQaIPIQ9PYd9fEqw70le  NLDplNuJxeg9ZzZpeEfPNe  Vy89Kb7cBiHt17-  ~VYOoen7gdJ9v7M~z0IVV  Ir8nrU8n~ljj6fEYV3GeQiN  DEHjqRm2o1-ynSK5rFw	le viewer gh HTTP tions. odle.TV st. The se tDude0.t kunQdE0 C~k- VREBiyy VISEAAp	s hosting Kidoodle content. On as are similarly encoded at multiple Get Requests by end users' devices, selects the <b>1800000 Bandwidth</b> version erver(s) returns the playlist file with the serverself server selects the playlist file with the erver server selects the <b>1800000 Bandwidth</b> version erver selects the <b>18000000 Bandwidth</b> version erver selects the <b>1800000 Bandwidth</b> version erver selects the <b>18000000 Bandwidth</b> version erver selects the <b>18000000 Bandwidth</b> version erver selects the <b>18000000 Bandwidth</b> version erver selects the <b>18000000000 Bandwidth</b> version erver selects the <b>18000000000000000000000</b>

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Claim Element	Example Infringement Evidence	
	https://vcdm-	
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude1.ts?Expires=1692058230&Signat	
	ure=CDpwAf98XhRNKYFrCcv-	
	ofhY3VrgZ6T7M~dt8AXR4VRuOrMTiwDrlCQfZ01vbPEmfi~L0OK6K9Y6rlItw3hSboVNYc-	
	Bs8Kxtaqz~kiDoN3TvSHmiaPcpjGO03IQ5nLbwn-	
	gcptixhXoqmhAYSfFJ8q1NrOHvq5WzlOKvx8v10snMl1mxS0fC5VRDXEYbkCvLSqe8OBa8	
	kev2TqT8dZw7uFepqygtWzr5C0u-	
	6nWGZHqw4vC0d~N50BQSxQ5bjMz28sAs1vw2KmnoYx4exlNb1EE6M6nUPCA3C9dc5tei7	
	fB4UUZDjALiy3x7tOF3Zd2KJg6yxsNQC3ER8sD8g98SQ&Key-Pair-	
	Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.083333,	
	https://vcdm-	
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=1692058230&Signat	
	ure=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-	
	Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBd	
	gfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok-	
	0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-	
	3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-	
	NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-	
	CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-	
	Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333,	
	https://vcdm-	
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signat	
	ure=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVa	
	HEnwXrSS4IRE0hHiU2tSZwupiy57B~-	
	ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLf	
	DUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-	
	eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-	

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Claim Element	Example Infringement Evidence
	ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw
	&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signat
	ure=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-
	IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-
	zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-
	y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-
	Xcd7C9pLd800urg-20HZuei-
	2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-
	Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=1692058230&Signat
	ure=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-
	ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53RunAwQ~p3j4P6
	3FEfL-ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-
	eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4ahEG-
	et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZpKD6UQPz8JI4
	OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signat
	ure=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFd
	SviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0
	wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb-
	p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1
	b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75YdM91BCDnFgTaB2DGh

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Claim Element	Example Infringement Evidence
	w9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signat
	ure=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oPERBiu3cpkU1bmx18V7z1k
	BeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-
	GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-
	kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkF
	xOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAO
	GTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=1692058230&Signat
	ure=BA-
	QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8IS2H2uktgoA
	vqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-
	bCEffj1tx7HH4CKlT3~~9ej~ZenH-
	~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT1CCM4eWrFn
	IrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-
	y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=1692058230&Signat
	ure=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA-
	P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9uG1gv6uaDU
	F-NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPfN~kJVa94-
	XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDACytArwL9~CtJ

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qifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg-vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX- DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB 0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW
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https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX- DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB
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ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB
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ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB
sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB
OPTGEGR. AciVotCPpI pTCpppWEggCOpg/V2E/Pgg5ggyvjakfVjWPD5ggb2UUZTE0gVwMEW
UK 1 SEU1~4SIABISKPEP I SPIIII W EGEC YPA4 I 3E4DGU3GGXYIEKIAJI V DK3QQUZUIZ I EYZAWNF W
4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-
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ture=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J39C0TOfHfhkuWX3GNV~B
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6YyHaHA~YwMvSqF0FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-
ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-
G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-
38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-
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https://vcdm-
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ture=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk2w0HmAaV5
pV1n11kWK-NV93ZRSPKyTc-
9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-
ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B-

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Claim Element	Example Infringement Evidence
	rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR-
	naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692058230&Signa
	ture=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39QN0fozRAJiDpxwfbGRLiCs
	cRoibOsDnp8g45-N1Dv-
	l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45U
	nLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKO
	etZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-
	ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692058230&Signa
	ture=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yKA45ce57fGCLQkOTs9rLwvG
	KYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYNWXti2HX96KWLRLluN9-
	xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4l
	Jq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VDvolOXbtWeRISpeUtqRcyPv
	lEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibmBRqlyB-
	y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.458333,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude15.ts?Expires=1692058230&Signa
	ture=EmKhQ97V1kC2nux03LOh0AsSs8x3T5uYyPU7uQwFWokFiT5Z11XPDOYuvT4gX8H2
	9x5ZwaGw9fzRPXaevWiB-ZyaBTwKdD5sNiXzC85OSWOECID-
	V10WE4FK0zsvdbK5AhvJ3UvtNzufrrcBM9deA1B0PD8NLxZ9at3GlebQlcoyuvMPmcogOD
	7uPWbGcRUMw~kfl6JvTlQDcqbh7Azckr8Pj85rDKpY7ffr3dNqHK45HTx4Hq8P6BJ5HsI7

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Claim Element	Example Infringement Evidence
	xXzimlgev1OuXSYnXwUib-ejbAqhnf-
	VcwgEuwFi2u9imp45LbHP~4ChIHJ2y5zkOvk6Vd6Rhlwe5QE~-91Ya7OA&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude16.ts?Expires=1692058230&Signa
	ture=D9tydyyfLvc63w423qjALtY-u7peL5T09eMLvlf3qIhCt-
	z8xRmbnXtpHEtXxwqI~tQqCssOLXwaC-EY-
	2o2wPfVMWWMVFw1vyi~T~DBrixO4J9gdgCnN7XiGrI8EbePchv5-H7e-
	ReOIuUWsSOryzM6xfIOlM1KN-
	dlXCqfCpIXnyOZOwsnVFAgxZcekcLrarB8e8SpE1wobXIogjk2DGMr3GmYymTXsGFiODw XBTMuhWRcV1TARZLMK69oozNgv6-Te97KflduUeZVt6zapVj-
	6Q8ZK7x7J9EFxmFwPXe7~SFFUQTxFMNJcu0esokmKOAR2tCxznBheaUR1Gag&Key-
	Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-CUE-OUT: 0
	#EXT-X-CUE-IN
	#EXTINF:8.375000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude17.ts?Expires=1692058230&Signa ture=G0-13akiy1zABYLlQcnx7Om3pfZaPh~26uL9-
	jwDy9bwyV6KOSVTJ9uknM13xLq12pki6n6V0cWIDrQvpsvz2Tl8~ewAUkjzwesP-
	1XnJuY9tolEBNTaipdcKKeCNLw8LB9El~9einSOyMxcXmzX7ieVVlu-A~wi2GwbcMUb-
	w8OlvYZjVa9yTxzoz2TUjkHqFmJQ6NJ4rrnmzIsAyFu75W71LOHC-J1vs0dbN-
	S581jzsrg6WtUI9CbxM59TmAdLLJfnKS7XAgU5a0u~0ZbPF5Ne4z3xFWkif4joJCRc8E991A
	Rl8BUoyFCth3z8vJDd-uDp5M-br~nKEfRI5ZvBg&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	The variant playlist file is an HLS playlist. Each line in the file path
	"361/670158/7/hls/S0E4_WorldsStrongestDude17.ts" that begins with "#EXTINF" specifies the length of the

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Claim Element	Example Infringement Evidence
	segments in seconds. The line below the #EXTINF file is the location of the video file. In the variant playlist
	shown above, the segments of the video are separated by commercial segments. Each of the streamlets (except
	the first and final streamlets of each playlist) is approximately 8-10 seconds long and returns sequential
	segments of the video program and/or commercial.
	As long as the viewer continues watching the video and the bandwidth is adequate to support the chosen
	resolution, the end user device will continue to request (and Kidoodle.TV will provide) streamlets corresponding
	to the current, chosen resolution.
[10.3] wherein the	Kidoodle videos are encoded at a plurality of different bitrates to create a plurality of streams including at least a
video is encoded at	low quality stream, a medium quality stream, and a high quality stream, wherein each of the low quality stream,
a plurality of	the medium quality stream, and the high quality stream comprises a streamlet that encodes the same portion of
different bitrates to	the video at a different one of the plurality of different bitrates.
create a plurality	
of streams	In the instant test, a personal computer accessing the Kidoodle.TV site through a web browser makes a HTTPS
including at least a	GET request to <b>prod.kidoodle.tv</b> for the Master Manifest of a video program titled "Dude Perfect." As shown in
low quality stream, a medium quality	the excerpts of the Master Manifest below, the video available is encoded at 4 different bitrates.
stream, and a high	#EXTM3U
quality stream,	#EXT-X-VERSION:3
wherein each of	#EXT-X-STREAM-
the low quality	INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
stream, the	8.m3u8
medium quality	#EXT-X-STREAM-
stream, and the	INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"
high quality	7.m3u8
stream comprises a	#EXT-X-STREAM-
streamlet that encodes the same	INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
portion of the	6.m3u8
video at a different	#EXT-X-STREAM-
one of the plurality	INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"
one of the plurality	5.m3u8

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Claim Element	Example Infringement Evidence		
of different	File path: manifest.m3u8		
bitrates;			
	The master playlist shows four versions of the video stream at the following bandwidths:		
	• 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270		
	,	referred to herein as "1800000 Bandwidth") having a resolution of 1280x720	
		ferred to herein as "500000 Bandwidth") having a resolution of 480x270	
	• 800000 (re	eferred to herein as "800000 Bandwidth") having a resolution of 720x406	
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:		
	Bandwidth Token <sup>3</sup>		
	300000	8.m3u8?	
	Bandwidth		
	1800000	7.m3u8?	
	Bandwidth		
	<b>500000</b> 6.m3u8?		
	Bandwidth		
	<b>800000</b> 5.m3u8?		
	Bandwidth		
	For example, the 3	vidth streams includes segments that encode the same portion of the video at various qualities. <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>500000 or 800000</b>	
	<b>Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000 Bandwidth</b> version can be		
	considered a high-quality stream.		

<sup>&</sup>lt;sup>3</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence
	As shown below, each of the 50	00000 Bandwidth and 1800000 Bandwidth version playlists contain segments,
	or streamlets, that encode segm	nents of the video program. The streamlet files within each version playlist are
	arranged in ascending chronolo	ogical order, beginning with the first segment of the video program, and
	progressing until the final segm	nent of the video program.
	Bandwidth	Streamlet (segment)
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm-
		cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169
		2058315&Signature=fvGyZzCNd-crO6-
		JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-
		ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit-
		SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv
		fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb
		-4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr-
		8Zf6oIUQQca-
		5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg_
		_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333,
		https://vcdm-
		cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169
		2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU
		QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr-
		KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-
		yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY
		AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-

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Claim Element	Example Infringement Evidence
	t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v
	Sst-
	smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-
	Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169
	2058315&Signature=YXXHRRu4Adc2jc-XdGykv-
	zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42
	qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L
	wMBsQXOJRCpWmU-vG6QW-
	OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0-
	Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW
	oEXkJRDttTXHtU5IKsfY-
	gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2
	Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169
	2058315&Signature=CM-bcy4GkvIZLwyvQ-
	oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2
	wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-
	Ll4ZQKe13SeDvD0M~woH-
	vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P
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Claim Element	Example Infringement Evidence	
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	c	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude <mark>6</mark> .ts?Expires=169
		2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs-
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		CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi-
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		)1-
	F	Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB
		LQ9oQeeUI3NiT97-
	l v	ıYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV
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	#	#EXTINF:9.500000,
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	2	2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE
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		Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-
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		XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H
		nQprIM2EVLbLulCYs7d-
	1	NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X

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Claim Element	Example Infringement Evidence	
	EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3	
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	d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq-	
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	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude <mark>9</mark> .ts?Expires=169	
	2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn-	
	IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa	
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	V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp	
	2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc	
	ZyVYSd2~kXj3CG-	
	AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-	
	vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
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Claim Element	Example Infringement Evidence
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	oGm-
	nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-
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	E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig
	yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG
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	qVVkpgIZkF1HrUvTWvHcEXkVv
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Claim Element	Example Infringement Evidence	
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		0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-
		3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-
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Claim Element	Example Infringement Evidence	
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	5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ	
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	y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-	
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Claim Element	Example Infringement Evidence	
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	p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I	
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence
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	etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc-
	9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-
	ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ
	twVnc-B-rQwaARTzxnztYW8tW~n19-
	HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR-
	naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6
	XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude <mark>13</mark> .ts?Expires=16
	92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E
	Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-
	12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEj13Gh0y0ghFEAOVN2b1EWT
	8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq
	v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD
	FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-
	T W uc41T III VaENVO NEIO SANUCO I aLIKLJUU-

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Claim Element	Example Infringement Evidence
	ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&
	Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16
	92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY
	b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH
	6J9WYNWXti2HX96KWLRLluN9-
	xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~
	FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp
	m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB-
	y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.
	Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams
	are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to
	switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same
	content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST
	have matching timestamps" to allow the video player accessing Kidoodle.TV to synchronize the media. Id.
	Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The
	Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize

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Claim Element	Example Infringement Evidence
	Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams
	MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
[10.4] wherein at least one of the low quality stream,	At least one of the low, medium, or high quality streams of the Kidoodle video is encoded at a bit rate of no less than 600 kbps.
medium quality	• 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270
stream, and high	• 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720

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Claim Element	Example Infringement Evidence
quality stream is	• 500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270
encoded at a bit	<ul> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>
rate of no less than	
600 kbps; and	For example, the <b>800000 Bandwidth</b> is encoded at more than 600 kbps.
[10.5] wherein the streamlet encoding the same portion of the video in the low quality stream has an equal playback duration as the streamlet encoding the same portion of the video in the high quality stream;	The streamlet encoding the same portion of the video in the low quality stream has an equal playback duration as the streamlet encoding the same portion of the video in the high quality stream.  As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player to synchronize the media. *ld.** Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.  As shown below, each of the 50000 Bandwidth and 1800000 Bandwidth version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program and progressing until the final segment of the video program. As noted above, the variant playlist file is an HLS playlist. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV uses HTTPS GET requests to request and retrieve the segments of the encoded stream specified in the file above. The video files are hosted at vcdm-cf.kidoodle.tv, and each streamlet (except the first and final streamlets) is approximately 8-10 seconds lo

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Claim Element		Example Infringement Evidence
	cf.kidoodle.tv//[X]/hls/S0E4_	WorldsStrongestDude3.ts," "https://vcdm-
	cf.kidoodle.tv//[X]/hls/S0E4_	_WorldsStrongestDude4.ts," "https://vcdm-
	cf.kidoodle.tv//[X]/hls/S0E4_	_WorldsStrongestDude5.ts," and "https://vcdm-
	cf.kidoodle.tv//[X]/hls/S0E4_	WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each
	bandwidth version. Within eac	h bandwidth playlist file, there are the 17 .ts files, each corresponding to the same
	segmented moments in the vide	20.
	Bandwidth	File line (#EXTINF: length) (portion of live stream)
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm-
		cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169
		2058315&Signature=fvGyZzCNd-crO6-
		JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-
		ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit-
		SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv
		fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb
		-4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr-
		8Zf6oIUQQca-
		5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg_
		_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333,
		https://vcdm-
		cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169
		2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU
		QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr-
		KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-

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Claim Element	Example Infringement Evidence
	yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY
	AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-
	t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v
	Sst-
	smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-
	Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169
	2058315&Signature=YXXHRRu4Adc2jc-XdGykv-
	zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42
	qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L
	wMBsQXOJRCpWmU-vG6QW-
	OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0-
	Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY-
	gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2
	Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169
	2058315&Signature=CM-bcy4GkvIZLwyvQ-
	oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2
	wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-
	Ll4ZQKe13SeDvD0M~woH-
	vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P
	YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4
	Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL
	sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:9.916667,	
	https://vcdm-	
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169	
	2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs-	
	gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL	
	CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi-	
	~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA	
	01-	
	Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB	
	LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV	
	Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm-	
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169	
	2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE	
	PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp	
	4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-	
	UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaB	
	Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-	
	1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-	
	xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-	
	Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	
	https://vcdm-	
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169	
	2058315&Signature=BXa7FwbB-	
	XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H	
	hQprIM2EVLbLulCYs7d-	

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Claim Element	Example Infringement Evidence	
	NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X	<b>X</b>
	EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3	3
	zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn	16
	04UoStbeCRxrNpEYOudkkm79k-	
	d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq-	
	o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm-	
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=16	69
	2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn-	
	IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LP	'sa
	d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO-	
	V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fS	-
	2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwr	rc
	ZyVYSd2~kXj3CG-	
	AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8o	c-
	vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.666667,	
	https://vcdm-	
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=1	
	92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq3	
	nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV	<b>V</b>
	PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn-	
	cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYss	
	00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35	
	dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwba	aJ
	yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm-	1.
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=1	16

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Claim Element	Example Infringement Evidence
	92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM
	8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH-
	RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc
	oGm-
	nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-
	0EsdN7ZUOam4P-
	E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig
	yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG
	ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16
	92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH
	15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC
	ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-
	qVVkpgIZkF1HrUvTWvHcEXkVv
	tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb
	Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4-
	jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987-
	4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
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	https://vcdm-
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16
	92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb-
	~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28
	K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t-
	Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf-
	9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC

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P3s s=16 i6to
s=16 ï6to
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uok-
s=

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Claim Element	Example Infringement Evidence
	NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-
	CYxuCpPt9d50a8kEBRDNl3Tt-
	WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169
	2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ
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	ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2
	5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ
	6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-
	ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8
	0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169
	2058230&Signature=eBd8Be4aj-
	PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-
	IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka
	Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-
	y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-
	IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-
	2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6
	x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169
	2058230&Signature=R83mjHLH07WWvwga8NT-
	JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-
	ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53

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Claim Element	Example Infringement Evidence
	RunAwQ~p3j4P63FEfL-
	ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-
	eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5
	hv4ahEG-
	et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq
	ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169
	2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz
	KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc
	JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd
	LrCplH9mJAnzYUbb-
	p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I
	4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH
	Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0-
	6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npjjqzEmXeNoxaQXIS
	2038250&Signature=RSaDQrCZJ FEdD99NGdedJ7c8npjqzEmXeNoxaQXiS 2~10PERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-
	OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-
	GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-
	kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ
	uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl
	wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA
	_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000,

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Claim Element	Example Infringement Evidence
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169
	2058230&Signature=BA-
	QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7
	K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39
	KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-
	~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR
	eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-
	U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-
	gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169
	2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA-
	P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi
	Nv9uG1gv6uaDUF-
	NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt
	MPfN~kJVa94-
	XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN
	DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-
	nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg-
	vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16
	92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V
	X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-
	ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-
	sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H
	5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie
	kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3

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Claim Element	Example Infringement Evidence		
	VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-		
	Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667,		
	https://vcdm-		
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-		
	G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-		
	38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-		
	B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.500000,		
	https://vcdm-		
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv-		
	t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp		
	etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc-		
	9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-		
	ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ		
	twVnc-B-rQwaARTzxnztYW8tW~n19-		
	HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR-		
	naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667,		
	https://vcdm-		
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16		
	92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E		
	Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-		
	l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT		
	8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq		

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Claim Element	Example Infringement Evidence
Claim Element	v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA #EXT-X-ENDLIST  On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above. Similarly, on information and belief, the other bandwidth version streamlets are the same durations as the <b>500000 Bandwidth</b>
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; see also RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the

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Claim Element	Example Infringement Evidence			
	<u> </u>	each segment on the Playlist timeline and its Discontinuity Sequence Number to locate		
	corresponding segr			
[10.6] select a		ice selects a specific one of the streams based upon a determination by the client module to		
specific one of the	select a higher or l	ower bitrate version of the streams.		
streams based				
upon a		eiver to adapt the bitrate of the media to the current network conditions in order to maintain		
determination by the client module		back at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client		
to select a higher		nuous stream of media from a server for concurrent presentation.").		
or lower bitrate	_	e, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the following bandwidths:		
version of the		ferred to herein as "300000 Bandwidth") having a resolution of 480x270		
streams;	· ·	eferred to herein as " <b>1800000 Bandwidth</b> ") having a resolution of 1280x720		
	,	ferred to herein as "500000 Bandwidth") having a resolution of 480x270		
	,	ferred to herein as "800000 Bandwidth") having a resolution of 720x406		
		/		
	For each of these v	versions, the master playlist provides a link to a playlist for the specified version of the		
	selected video prog	gram at a particular bandwidth and resolution. Each version playlist is defined by the token		
	associated with the	he stream file path. For example:		
	Bandwidth	Token <sup>4</sup>		
	300000	8.m3u8?		
	Bandwidth			
	<b>1800000</b> 7.m3u8?			
	Bandwidth			
	<b>500000</b> 6.m3u8?			
	Bandwidth			
	<b>800000</b> 5.m3u8?			
	Bandwidth			

<sup>&</sup>lt;sup>4</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence				
	streamlets. request and the 500000 500000 Ba 1800000 B	Upon a determination that receive the 300000 Band Bandwidth version of the standwidth version of	poodle.TV requests and receives the 1 at the higher bitrate cannot be supported and the streamlets. The streamlets can be supported, and streamlets. Then, the End User Device streamlets can be supported, and substreamlets. Below is an excerpt of the requests.	rted, the Endsubsection the En	he End User Device switches to I User Device then determines that quently requests and receives the determines that the higher ently requests and receives the
	Method	Host	Path		Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete

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Claim Element	Example Infringement Evidence			
	allow Kidoodle to synchron an integer Discontinuity Sec timestamps within the media	that "[m]atching content in Variant Streams MUST have matching timestamps" to ize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has quence Number. The Discontinuity Sequence Number can be used in addition to the a to synchronize Media Segments across different Renditions." RFC 8216 at 39. In Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC		
[10.7] place a streamlet request to the server over	The End User Device places selected stream.	s a streamlet request to the server over the one or more network connections for the		
the one or more network connections for the selected stream;	The variant playlists file are HLS playlists. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV requests and retrieves the segments of the encoded stream specified in the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> , and each streamlet (except the first and final streamlets) is approximately 8-10 seconds long.			
	The received playlists at each	The received playlists at each resolution includes video streamlets, such as: "https://vcdm-		
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-			
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-			
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-			
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-			
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each			
	bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same			
		segmented moments in the video.		
		Bandwidth Version File line (#EXTINF: length) (portion of live stream)		
	500000 Bandwidth	#EXTM3U #EXT-X-VERSION:3		
		#EXT-X-VERSION:5 #EXT-X-TARGETDURATION:11		
		#EXT-X-TARGET DOKATION.TT #EXT-X-MEDIA-SEQUENCE:0		
		#EXTINF:10.083333,		

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Claim Element	Example Infringement Evidence		
	https://vcdm-		
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920		
	58315&Signature=fvGyZzCNd-crO6-		
	JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-ERIBXKGkK~-		
	uCNrFq64LsvX~X~EPT8I5qybYZUit-		
	SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMvfBl		
	YgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb-		
	4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr-		
	8Zf6oIUQQca-		
	5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&		
	Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.333333,		
	https://vcdm-		
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920		
	58315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigUQOQg		
	L~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr-		
	KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-		
	yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLYAeE		
	62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-		
	t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~vSst-		
	smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair-		
	Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.416667,		
	https://vcdm-		
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920		
	58315&Signature=YXXHRRu4Adc2jc-XdGykv-		
	zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42qpY		
	mam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~LwMBsQ		
	XOJRCpWmU-vG6QW-		
	OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0-		

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Claim Element	Example Infringement Evidence		
	Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYWoEX		
	kJRDttTXHtU5IKsfY-		
	gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2Bj9g		
	&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.125000,		
	https://vcdm-		
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920		
	58315&Signature=CM-bcy4GkvIZLwyvQ-		
	oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2ww		
	J4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-		
	Ll4ZQKe13SeDvD0M~woH-		
	vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PY		
	WZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU		
	4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ3I8tv		
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Claim Element	Example Infringement Evidence		
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	UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~		
	4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-		
	anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS-		
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	Sd2~kXj3CG-AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-		
	T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
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Claim Element	Example Infringement Evidence		
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	cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf00w		
	m8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35dQoPsu		
	4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJyml8sALw		
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	~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4-		
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Claim Element	Example Infringement Evidence		
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		058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb-	
		~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28K9	
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		Ia-iZ8hL6vn4t-	
		Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf-	
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		Qgeix7e6gBfICuZQf-	
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence		
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	ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-		
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	ahEG-		
	et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZp		
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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	058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39
	QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-
	l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT8W
	~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CW
	xRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41F
	mvaEMv8NErO3ANuCG1aLIkLJdb-
	ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-
	Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692
	058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yK
	A45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYN
	WXti2HX96KWLRLluN9-
	xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~Fm
	cQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VD
	volOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibm
	BRqlyB-
	y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to
	the same portion of video as is respective counterpart in the streamlet files shown above.
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant
	Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment
	MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media
	Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue

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Claim Element	Example Infringement Evidence
	uninterrupted." RFC 8216 at 6; see also RFC 8216 at 45 ("A client MUST NOT assume that segments with the
	same Media Sequence Number in different Variant Streams or Renditions have the same position in the
	presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the
	relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate
	corresponding segments.").
	Indeed, to adapt playback between different bitrate Variant Streams, the End User Device "can use the EXTINF
	durations and the constraints in Section 6.2.4 to determine the approximate location of corresponding media.
	Once media from the new Variant Stream has been loaded, the timestamps in the Media Segments can be used
	to synchronize the old and new timelines precisely." RFC 8216 at 47.
	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of
	the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to
	streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between"
	Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on
	playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have
	matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media
	Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence
	Number can be used in addition to the timestamps within the media to synchronize Media Segments across
	different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching
	Discontinuity Sequence Numbers." RFC 8216 at 43.
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain
	uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client
	can receive a continuous stream of media from a server for concurrent presentation.").  For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b>
	version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device
	switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then
	determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests
	and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that
	the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and
	receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence"
	listing showing the same alongside the status of the requests.
	I noting one wind the same atongorde the same of the requests.

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#### **U.S. Patent No. 10,469,555 to Kidoodle**

im Element	Example Infringement Evidence				
	Method	Host	Path		Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest		Complete
			Dude6.ts?		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest		Complete
			Dude7.ts?		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest		Complete
			Dude8.ts?		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest		Complete
			Dude9.ts?		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest		Complete
			Dude10.ts?		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest		Complete
			Dude11.ts?		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest		Complete
			Dude12.ts?		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest		Complete
			Dude13.ts?		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest		Complete
			Dude14.ts?		

The Kidoodle "[p]laylist files contain URIs, which clients will use to make network requests of arbitrary entities." RFC 8216 at 55. When playback starts on the video player, "[t]he client," which is the video player, "SHALL choose which Media Segment to play first from the Media Playlist." RFC 8216 at 45; *id.* at 47 ("The first segment to load is generally the segment that the client has chosen to play first (see Section 6.3.3)."). Then, "[i]n order to play the presentation normally, the next Media Segment" the video player requests and "load[s] the one with the lowest Media Sequence Number that is greater than the Media Sequence Number of the last Media Segment loaded." RFC 8216 at 47. That is, to playback normally, the video player must request a plurality of files with sequential Media Sequence Numbers/timestamps and the requests are made based on the Media Sequence Numbers/timestamps.

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Claim Element			Example Infringement Evidence	e		
		As shown above, although the End User Device accessing Kidoodle.TV requests the <b>1800000 Bandwidth</b>				
	version of the program, it quickly switches to requesting the <b>300000 Bandwidth</b> , then <b>500000 Bandwidth</b> back to the <b>1800000 Bandwidth</b> version when bandwidth is adjusted. Those requests, as shown above, are					
	"Complete	d," meaning the streamlets	s were received from the one or mor	e Kid	oodle servers.	
[10.8] receive the requested	correspond	On information and belief, playlists for the other resolution variants also include these segments, which correspond to the same portion of the video provided from the server(s).  The End User Device accessing Kidoodle.TV receives the requested streamlets from the server via the one or				
streamlets from	more netwo	ork connections.				
the server via the one or more network connections; and	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").  For the instant test, the End User Device accessing Kidoodle.TV requests and receives the 1800000 Bandwidth version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the 300000 Bandwidth version of the streamlets. The End User Device then determines that the 500000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 500000 Bandwidth version of the streamlets. Then, the End User Device then determines that the higher 1800000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets. Below is an excerpt of the Charles "Sequence"					
	Method	wing the same alongside the Host	Path		Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest		Complete	
	GET	vcdm-cf.kidoodle.tv	Dude6.ts?		Complete	
	GE I	vcdiii-ci.kidoodie.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete	

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest		Complete
			Dude10.ts?		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest	•••	Complete
			Dude11.ts?		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest	•••	Complete
			Dude12.ts?		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest	• • •	Complete
			Dude13.ts?		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest	•••	Complete
			Dude14.ts?		
	*** 1 11	//F 31 11 . Ct1			
		-1 - 0	RIs, which clients will use to make n		•
		± •	rts on the video player, "[t]he client,		<u> </u>
			th Media Segment to play first from tenerally the segment that the client leads to the		· · · · · · · · · · · · · · · · · · ·
	`	e e	e presentation normally, the next M		1 0
	, ,		e lowest Media Sequence Number th		•
	-		oaded." RFC 8216 at 47. That is, to		
		Device must request a plurality of files with sequential Media Sequence Numbers/timestamps and the requests			
		based on the Media Sequer	•	- (0,111)	cors, consessionaps data and requests
			Jser Device accessing Kidoodle.TV	reque	ests the 1800000 Bandwidth
		,	vitches to requesting the 300000 Bar	-	
			sion when bandwidth is adjusted. Th		•
			s were received from the one or mor		
[10.9] provide the	The End U	Jser Device accessing Kide	podle.TV provides the received stream	mlets	s for playback of the video.
received streamlets	_				
for playback of the	-		eamlet via an HTTP GET request, a		
video.	U		requested streamlet from the server		
		<b>©</b> 1	("Using this protocol, a client can r		
	from a ser	ver for concurrent presenta	ation."); id. at 5 ("To play this Playli	st, the	e client first downloads it and then

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Claim Element	Example Infringement Evidence					
		downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this				
	document to discover any added segments.").					
	For the ins	tant test, the End User Dev	vice accessing Kidoodle.TV request	s and	receives the 1800000 Bandwidth	
			ermination that the higher bitrate ca			
	switches to	request and receive the 30	00000 Bandwidth version of the str	eamle	ets. The End User Device then	
			th version of the streamlets can be			
			version of the streamlets. Then, the			
	_		on of the streamlets can be supported		1 1	
		e <b>1800000 Bandwidth</b> ver wing the same alongside th	rsion of the streamlets. Below is an	excer	pt of the Charles "Sequence"	
	Method	Host	Path		Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest		Complete	
			Dude6.ts?			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest		Complete	
			Dude7.ts?			
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest	•••	Complete	
			Dude8.ts?			
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	Dude9.ts?		Complete	
	GEI	vcam-ci.kidoodie.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest		Complete	
		vedin ci.kidoodic.tv	Dude11.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest		Complete	
			Dude12.ts?			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest		Complete	
			Dude13.ts?			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest	•••	Complete	
			Dude14.ts?			

Claim Element	Example Infringement Evidence
	Kidoodle confirms that the video player provides video playback to end user stations over a network connection on the Kidoodle support webpage, <a href="https://about.kidoodle.tv/faq/">https://about.kidoodle.tv/faq/</a> . There, Kidoodle troubleshoots problems end users may have with HLS and instructs users on how to optimize their video playback experience. <i>See</i> <a href="https://about.kidoodle.tv/faq/">https://about.kidoodle.tv/faq/</a> .
	Why isn't Kidoodle.TV® working?
	We have worked hard to create a service that can be accessed across as many devices as possible, but as with all technology there are times when it may not work properly. There are a number of reasons why this can happen including simple connectivity issues to more complex ones. If you're experiencing any issues, please try the following:  1. Confirm that you are connected to a WIFI network and that the connection is strong.  2. Close the app and re-launch it.  3. Sign out of your account (if you have one) and log back in.  4. Check to see if there is a recent update, and if so, update the app.  5. Delete the app from your device and re-install it.
	If the problem persists, please contact us and we would be more than happy to try and find a solution.  When sending us a message, please take note of any error codes you may see, and provide as much detailed information as possible, including the device you're streaming on.
	Does Kidoodle.TV® work while I'm offline?  Unfortunately, Kidoodle.TV is a streaming service and as such you must be connected to a WIFI network or use data to watch.

# **EXHIBIT S**

#### U.S. Patent No. 8,868,772 to Kidoodle

The following claim chart shows exemplary aspects of A Parent Media Co. Inc.'s Kidoodle.TV streaming services and products ("Kidoodle") that infringe claim 1 of the '772 Patent. The chart is exemplary and should not be read to limit DISH's assertions against Kidoodle, or any other streaming services offered by A Parent Media Co. Inc. or Kidoodle as to the services or products described below. The chart should not be read to limit DISH's assertions to the patent claim charted below. Nor should the chart below be read to limit how Kidoodle infringes the claim below.

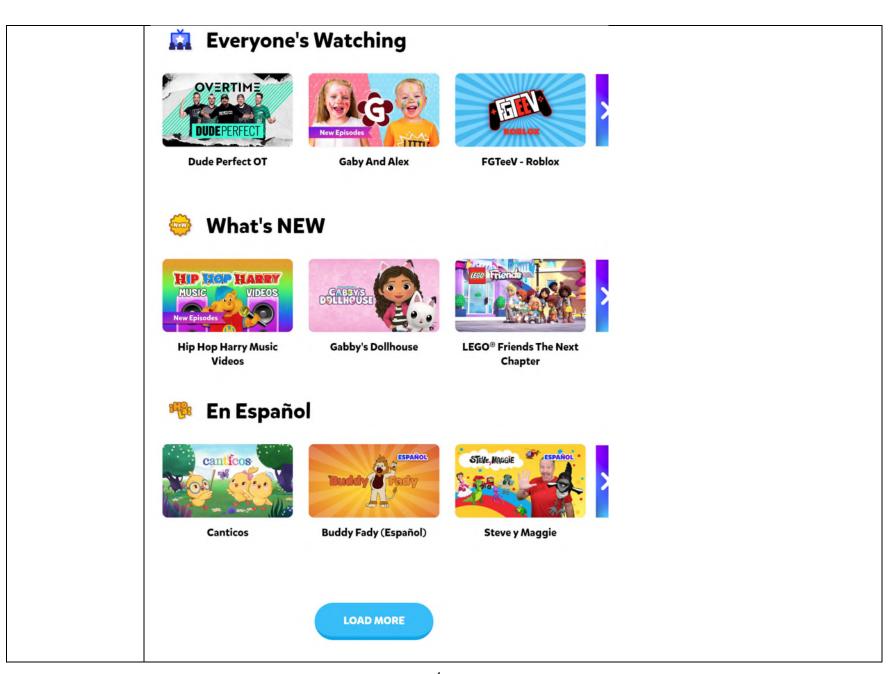
Claim Element		<b>Example Infringement Evidence</b>	
[1.pre] A method for presenting rateadaptive streams, the method comprising:	streaming. Kidoodle is executable by streams include live streams that are of the images in this chart are from a definition Microsoft Edge, Google Chrome, or in	pplications that practices a method for prodevices that obtain streams of a selected obtained from one or more servers affiliate evice accessing the Kidoodle.tv website OS Safari. Kidoodle.tv supports all majorial able across all available platforms.")	d video program for playback. The ated with Kidoodle over a network. through a web browser, such as or web browsers. <i>See</i>
	Curated Content  No fancy algorithms here. Every show available on our service has been watched and screened by a real human being.  https://about.kidoodle.tv/ ("We're ava	Parental Controls  Be the best parent, even when you're not there. Bedtimes, curfews, analytics, and more features are available to all users.  ailable across all available platforms.")	Easy-to-Watch  Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.

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Claim Element	Example Infringement Evidence
	Kidoodle also includes applications for all platforms, including Apple App Store for iOS devices, Google Play for Android devices, Roku, and Amazon Fire TV, which also access the Kidoodle.tv website to stream video content. See <a href="https://about.kidoodle.tv/watch-now/">https://about.kidoodle.tv/watch-now/</a>
	KiDoodleth
	Download our App!
	Download on the App Store Google Play Roku Available on the Channel Store WATCH ON amazon fireTV
	https://about.kidoodle.tv/watch-now/
	Upon information and belief, the aforementioned device that accesses Kidoodle.tv through a website, and the applications that access Kidoodle.tv (collectively, "End User Device") operate in the same or substantially the same way for purposes of this chart.

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Example Infringement Evidence
The one or more servers accessible by Kidoodle store video files which are streamed to the end user stations.
The following are examples of the videos that may be streamed from the one or more servers to the End User
Device(s). See <a href="https://kidoodle.tv/">https://kidoodle.tv/</a> .



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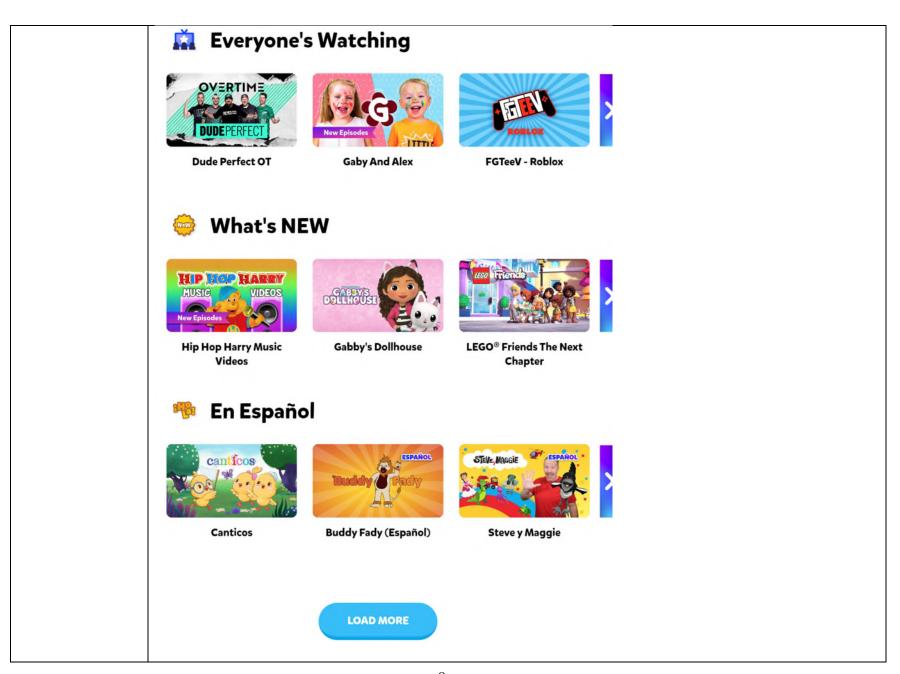
Claim Element	Example Infringement Evidence		
	https://kidoodle.tv/.  Tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the media player embedded in the Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.		
	Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.		
	With respect to adaptively receiving the digital stream from the video server over the network, the media player embedded in the Kidoodle.TV site accesses adaptive bitrate streams are provided to the media player from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.		
[1.1] streaming by a media player	The End User Device accessing Kidoodle.TV includes a media player operating on the end user station to stream a video from a set of one or more servers affiliated with Kidoodle.		
operating on an end user station a video from a set of one or more servers,	As explained above, tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the <u>media player embedded in the</u>		

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Claim Element	Example Infringement Evidence
	Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.
	Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.
	With respect to adaptively receiving the digital stream from the video server over the network, the <a href="mailto:media player embedded">media player</a> embedded in the Kidoodle.TV site accesses adaptive bitrate streams are provided to the media player from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.
	Through the established network connection, the devices streaming Kidoodle access video programs that are stored on one or more servers for display on the devices via the video player accessing the Kidoodle.TV site. See

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Claim Element	Example Infringement Evidence		
	also		
	Curated Content  No fancy algorithms here. Every show available on our service has been watched and screened by a real human being.	Parental Controls  Be the best parent, even when you're not there. Bedtimes, curfews, analytics, and more features are available to all users.	Easy-to-Watch  Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
	The one or more servers accessible by	e available across all available platfor V Kidoodle store video files which are a cleos that may be streamed from the one	streamed to the end user stations.



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Claim Element	Example Infringement Evidence
	https://kidoodle.tv/.
[1.2] wherein each of a plurality of different copies of the video encoded at different bit rates is stored as multiple files on the set of servers,	The one or more servers accessible by the End User Device store multiple different copies of the video encoded at different bit rates are stored on the one or more servers as multiple sets of files.  For example, in the instant test of a video titled "Dude Perfect," the end user station: established a network connection, connected with the one or more servers, and the End User Device made an HTTP GET request to prod.kidoodle.tv for a master manifest located at the following path:  https://prod.kidoodle.tv/api/2.0/content/elemental-source/web/2545/94152/670158/watch/manifest.m3u8  (hereafter referred to as the "Master Manifest" or "manifest.m3u8"). The Master Manifest returned the following contents, reflecting the Uniform Resource Indicators ("URIs") of the various variant playlists hosting at least a group of streamlets:
	#EXTM3U
	#EXT-X-VERSION:3
	#EXT-X-STREAM-INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	8.m3u8
	#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"
	7.m3u8
	#EXT-X-STREAM-INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	6.m3u8

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Claim Element	Example Infringement Evidence			
	#EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2" 5.m3u8			
	File path: manife	est.m3u8		
	The master playli	st shows four versions of the video stream at the following bandwidths:		
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> <li>For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:</li> </ul>			
	Bandwidth	Token <sup>1</sup>		
	300000 8.m3u8? Bandwidth			
	1800000 7.m3u8? Bandwidth			

<sup>&</sup>lt;sup>1</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence				
	500000 Bandwidt	6.m3u8?				
	800000 Bandwidt	5.m3u8?	5.m3u8?			
	For exampl <b>Bandwidth</b>	Each of the bandwidth streams includes segments that encode the same portion of the video at various qualities. For example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>500000 or 800000 Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000 Bandwidth</b> version can be considered a high-quality stream.				
	The End User Device also uses HTTPS GET requests to retrieve the segments, or streamlets, of the encoded video specified in the file above.					led
	The Media Playlist for each of the Variant Streams identifies a group of streamlets associated with different copies, as the exemplary Media Playlist shown below illustrates. <i>See</i> RFC 8216 at 38 ("The must create a Media Playlist file (Section 4) that contains a URI for each Media Segment that the set to make available, in the order in which they are to be played."); <i>see also</i> RFC 8216 at 4 ("A multipersentation is specified by a Uniform Resource Identifier (URI) [RFC3986] to a Playlist."); RFC 8 Media Playlist contains a series of Media Segments that make up the overall presentation. A Media specified by a URI and optionally a byte range.").				s. See RFC 8216 at 38 ("The serv Media Segment that the server w RFC 8216 at 4 ("A multimedia 986] to a Playlist."); RFC 8216 at	ver vishes t 4 ("A
	As shown by the Charles Proxy application file, partially reproduced below, the streamlet video files are hosted on a server accessible via https://vcdm-cf.kidoodle.tv/. The server accesses the stored streamlet files for playback on an end user device.					
	Method	Host	Path <sup>2</sup>		Status	

<sup>&</sup>lt;sup>2</sup> Video path abbreviated for readability throughout.

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Claim Element	Example Infringement Evidence					
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 0.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 1.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 2.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 3.ts?		Complete	
	As showr of the stre	s.  in the test data, the End U	Jser Device accessing Kido	odle.TV	y perform the demonstrated claim  T selects the <b>1800000 Bandwidth</b> verver(s) returns the playlist file with	
		EXTM3U				
		EXT-X-VERSION:3	NON 11			
		EXT-X-TARGETDURAT				
		EXT-X-MEDIA-SEQUEN	ICE:U			
	#1	EXTINF:10.750000,				

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Claim Element	Example Infringement Evidence			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude0.ts?Expires=1692058230&Signat ure=X-j9VAHmYvweCM- dblOesIErSUUPPye19SnCx9oSQaIPIQ9PYd9fEqw70kunQdE0c9VdJUJT05ewHTOHxwr0fXs g1UCjh2MBBBXuSguMBNLDplNuJxeg9ZzZpeEfPNC~k- GWyC79vUAs1SasIIG1VfVy89Kb7cBiHt17- baaBU01zty90WpmmejGY~vYOoen7gdJ9v7M~z0lVVREBiyygE7A0vGww6pEpEMztwSZZ4 ZoBkCdhZmLe3vjUm5MMr8nrU8n~ljj6fEYV3GeQiNlSEAApGW1qa5cNtQOhfX2ClzKrGHx paXUKqEheDRGyCs2u3bOEHjqRm2o1-ynSK5rFw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EYTINE:0.250000			
	#EXTINF:9.250000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude1.ts?Expires=1692058230&Signat ure=CDpwAf98XhRNKYFrCcv- ofhY3VrgZ6T7M~dt8AXR4VRuOrMTiwDrlCQfZ01vbPEmfi~L0OK6K9Y6rlItw3hSboVNYc- Bs8Kxtaqz~kiDoN3TvSHmiaPcpjGO03IQ5nLbwn- gcptixhXoqmhAYSfFJ8q1NrOHvq5WzlOKvx8v10snMl1mxS0fC5VRDXEYbkCvLSqe8OBa8 kev2TqT8dZw7uFepqygtWzr5C0u- 6nWGZHqw4vC0d~N50BQSxQ5bjMz28sAs1vw2KmnoYx4exlNb1EE6M6nUPCA3C9dc5tei7 fB4UUZDjALiy3x7tOF3Zd2KJg6yxsNQC3ER8sD8g98SQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.083333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=1692058230&Signat ure=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBd gfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-			

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Claim Element	Example Infringement Evidence				
	NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.333333,				
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signat ure=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVa HEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLf DUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.416667,				
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signat ure=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.125000,				
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=1692058230&Signat ure=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53RunAwQ~p3j4P6				

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Claim Element	Example Infringement Evidence	
	3FEfL-ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZpKD6UQPz8JI4 OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signat ure=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFd SviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0 wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1 b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75YdM91BCDnFgTaB2DGh w9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signat ure=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXIS2~1oPERBiu3cpkU1bmx18V7z1k BeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkF xOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAO GTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=1692058230&Signat ure=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8IS2H2uktgoA	

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Claim Element	Example Infringement Evidence
	vqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT1CCM4eWrFn IrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2- y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=1692058230&Signat ure=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9uG1gv6uaDU F-NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDACytArwL9~CtJ qifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw- rtvvpM2YO35x3QnHMYJlpNjIg-vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX- DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB 0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW 4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692058230&Signa

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Claim Element	Example Infringement Evidence
	ture=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J39C0TOfHfhkuWX3GNV~B 7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk 6YyHaHA~YwMvSqF0FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692058230&Signa ture=AcGGiMOj6opQRc-iQhv-t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk2w0HmAaV5 pV1n11kWK-NV93ZRSPKyTc-9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR-naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692058230&Signa ture=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39QN0fozRAJiDpxwfbGRLiCs cRoibOsDnp8g45-N1Dv- l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45U nLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKO etZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692058230&Signa ture=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yKA45ce57fGCLQkOTs9rLwvG KYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4l Jq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VDvolOXbtWeRISpeUtqRcyPv IEGMQsBtgT2E2IfmnXKJIPyRTR1~rR8gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.458333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude15.ts?Expires=1692058230&Signa ture=EmKhQ97V1kC2nux03LOh0AsSs8x3T5uYyPU7uQwFWokFiT5Z1lXPDOYuvT4gX8H2 9x5ZwaGw9fzRPXaevWiB-ZyaBTwKdD5sNiXzC85OSWOECID- V1OWE4FK0zsvdbK5AhvJ3UvtNzufrrcBM9deA1B0PD8NLxZ9at3GlebQlcoyuvMPmcogOD 7uPWbGcRUMw~kfl6JvTlQDcqbh7Azckr8Pj85rDKpY7ffr3dNqHK45HTx4Hq8P6BJ5HsI7 xXzimlgev1OuXSYnXwUib-ejbAqhnf- VcwgEuwFi2u9imp45LbHP~4ChIHJ2y5zkOvk6Vd6Rhlwe5QE~-91Ya7OA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude16.ts?Expires=1692058230&Signa ture=D9tydyyfLvc63w423qjALtY-u7peL5T09eMLvlf3qIhCt- z8xRmbnXtpHEtXxwqI~tQqCssOLXwaC-EY- 2o2wPfVMWWMVFw1vyi~T~DBrixO4J9gdgCnN7XiGrI8EbePchv5-H7e- ReOIuUWsSOryzM6xfIOIM1KN- dlXCqfCpIXnyOZOwsnVFAgxZcekcLrarB8e8SpE1wobXIogjk2DGMr3GmYymTXsGFiODw XBTMuhWRcV1TARZLMK69oozNgv6-Te97KflduUeZVt6zapVj-	

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Claim Element	Example Infringement Evidence
	6Q8ZK7x7J9EFxmFwPXe7~SFFUQTxFMNJcu0esokmKOAR2tCxznBheaUR1Gag&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-CUE-OUT: 0
	#EXT-X-CUE-IN
	#EXTINF:8.375000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude17.ts?Expires=1692058230&Signa ture=G0-13akiy1zABYLlQcnx7Om3pfZaPh~26uL9-jwDy9bwyV6KOSVTJ9uknM13xLq12pki6n6V0cWIDrQvpsvz2Tl8~ewAUkjzwesP-1XnJuY9tolEBNTaipdcKKeCNLw8LB9El~9einSOyMxcXmzX7ieVVlu-A~wi2GwbcMUb-w8OlvYZjVa9yTxzoz2TUjkHqFmJQ6NJ4rrnmzIsAyFu75W71LOHC-J1vs0dbN-S581jzsrg6WtUI9CbxM59TmAdLLJfnKS7XAgU5a0u~0ZbPF5Ne4z3xFWkif4joJCRc8E991A R18BUoyFCth3z8vJDd-uDp5M-br~nKEfRI5ZvBg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXT-X-ENDLIST
	The variant playlist file is an HLS playlist. Each line in the file path "361/670158/7/hls/S0E4_WorldsStrongestDude17.ts" that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the variant playlist shown above, the segments of the video are separated by commercial segments. Each of the streamlets (except the first and final streamlets of each playlist) is approximately 8-10 seconds long and returns sequential segments of the video program and/or commercial.
	As long as the viewer continues watching the video and the bandwidth is adequate to support the chosen resolution, the end user device will continue to request (and Kidoodle.TV will provide) streamlets corresponding to the current, chosen resolution.

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Claim Element		Example Infringement Evidence
	On information and belief, the of files.	other bandwidth versions of the test video contain the same number of streamlet
[1.3] wherein each of the multiple files yields a different portion of the video on playback,	different copies of the video end Additionally, each of the multip. Each of the Media Segments in provides that "[e]ach segment in Sequence Number of the first set 4.3.3.2). The Media Sequence Negment that precedes it plus on continuation of the encoded bits where values in a series such as at 6. Thus, each of the streamlet Each of the bandwidth streams. For example, the 300000 Bands Bandwidth version can be consconsidered a high-quality stream. As shown below, each of the 50 or streamlets, that encode segments.	00000 Bandwidth and 1800000 Bandwidth version playlists contain segments, ents of the video program. The streamlet files within each version playlist are gical order, beginning with the first segment of the video program and
	Bandwidth	Streamlet (segment)
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3

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Claim Element	Example Infringement Evidence
	#EXT-X-TARGETDURATION:11
	#EXT-X-MEDIA-SEQUENCE:0
	#EXTINF:10.083333,
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst-

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Claim Element	Example Infringement Evidence
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	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude <b>5</b> .ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH-
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence	
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	

# Case 1:23-cv-01000-GBW Document 1-1 Filed 09/08/23 Page 624 of 863 PageID #: 678

Claim Element	Example Infringement Evidence
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	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6-Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp-E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t-ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
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Claim Element		Example Infringement Evidence
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		#EXTINF:10.333333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ

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Claim Element	Example Infringement Evidence
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	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude <mark>5</mark> .ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
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Claim Element	Example Infringement Evidence
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT

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8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&
Key-Pair-Id=APKAIPJESLAK2PMGD4PA
#EXTINF:10.333333,
https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9-xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryl5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB-y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
#EXT-X-ENDLIST
on information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle. TV (such as live videos) provide the same limitations.  ach of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant
2

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Claim Element	Example Infringement Evidence
	are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle. TV to synchronize the media. <i>Id</i> . Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.  The streamlets across the different copies yield the same portions of the video on playback. As set forth above,
	each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to

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Claim Element		Example Infringement Evidence
		witch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST on playback. RFC 8216 at 43.
[1.4] wherein the multiple files across the different copies yield the same portions of the video on playback,	As described above, the one or more servers accessible by the End User Device store each of a plurality of different copies of the video encoded at different bitrates and stored as multiple files on the set of servers, wherein each of the multiple files yields a different portion of the video on playback. Additionally, the multiple files across the different copies yield the same portions of the video on playback.  The master playlist shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270  • 1800000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270  • 500000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406  For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:	
	Douglast 14h	Takan <sup>3</sup>
	Bandwidth	Token <sup>3</sup>
	300000 Bandwidth	8.m3u8?

<sup>&</sup>lt;sup>3</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence
	<b>1800000</b> 7.m <b>Bandwidth</b>	n3u8?
	500000 6.m Bandwidth	n3u8?
	800000 5.m Bandwidth	n3u8?
	For example, the 300000 Bandwidth version can considered a high-qualit. As shown below, each of or streamlets, that encode arranged in ascending changed.	treams includes segments that encode the same portion of the video at various qualities.  Description Bandwidth version can be considered a low-quality stream, the 500000 or 800000 be considered a medium-quality stream, and the 1800000 Bandwidth version can be y stream.  If the 500000 Bandwidth and 1800000 Bandwidth version playlists contain segments, le segments of the video program. The streamlet files within each version playlist are pronological order, beginning with the first segment of the video program and all segment of the video program.
	Bandwidth	Streamlet ( <u>segment</u> )
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg_ &Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdkIIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRL1Aoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169

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Claim Element	Example Infringement Evidence
	zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJID6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA

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Claim Element	Example Infringement Evidence
	01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp
	4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAuxPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H
	hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k-

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Claim Element	Example Infringement Evidence
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	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG- AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c- vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn-cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf 00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16

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Claim Element	Example Infringement Evidence	
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	RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm-	
	nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P-	
	E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx	

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Claim Element		Example Infringement Evidence
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		#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:9.666667, #EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U #EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11 #EXT-X-MEDIA-SEQUENCE:0

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Claim Element	Example Infringement Evidence
	#EXTINF:10.083333,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVI- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-
	3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA#EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ 6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57- ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj-

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Claim Element	Example Infringement Evidence
	PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I

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Claim Element	Example Infringement Evidence
	4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS 2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA
	&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39 KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-
	~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-

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Claim Element	Example Infringement Evidence
	ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA#EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude 13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333,

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.
	Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle.TV to synchronize the media. <i>Id</i> . Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize

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Claim Element	Example Infringement Evidence
	Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
[1.5] each of said files having a time index such that the files whose playback is the	As described above, the one or more servers accessible by the End User Device store each of a plurality of different copies of the video encoded at different bitrates and stored as multiple files on the set of servers, wherein each of the multiple files yields a different portion of the video on playback, and wherein the multiple files across the different copies yield the same portions of the video on playback. Additionally, each of said files

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Claim Element	Example Infringement Evidence
same portion of the video for each	having a time index such that the files whose playback is the same portion of the video for each of the different copies have the same time index in relation to the beginning of the video.
of the different copies have the same time index in relation to the beginning of the video, and	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
	In the instant test, a personal computer accessing the Kidoodle.TV site through a web browser makes a HTTPS GET request to <b>prod.kidoodle.tv</b> for the Master Manifest. As shown in the excerpts of the Master Manifest below, the video available is encoded at 4 different bitrates.
	#EXTM3U #EXT-X-VERSION:3
	#EXT-X-VERSION.3  #EXT-X-VERSION.3  #EXT-X-STREAM- INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	8.m3u8

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Example Infringement Evidence	
#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"	
7.m3u8	
#EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"	
6.m3u8	
#EXT-X-STREAM-INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"	
5.m3u8	
File path: manifest.m3u8	
The master playlist shows four versions of the video stream at the following bandwidths:	
<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>	
For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:	
	#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"  7.m3u8  #EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"  6.m3u8  #EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"  5.m3u8  File path: manifest.m3u8  The master playlist shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270  • 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 480x270  • 500000 (referred to herein as "500000 Bandwidth") having a resolution of 720x406  For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token

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Claim Element	Example Infringement Evidence		
	Bandwidth	Token <sup>4</sup>	
	300000 Bandwidth	8.m3u8?	
	1800000 Bandwidth	7.m3u8?	
	500000 Bandwidth	6.m3u8?	
	800000 Bandwidth	5.m3u8?	
	Each of the bandwidth streams includes segments that encode the same portion of the video at various quere For example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>500000 or 800 Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000 Bandwidth</b> version can be considered a high-quality stream.		width version can be considered a low-quality stream, the 500000 or 800000 idered a medium-quality stream, and the 1800000 Bandwidth version can be
	or streamlets, that arranged in ascend	encode segme ling chronolog	0000 Bandwidth and 1800000 Bandwidth version playlists contain segments, ents of the video program. The streamlet files within each version playlist are gical order, beginning with the first segment of the video program and ent of the video program.
	Bandwidth		Streamlet (segment)
	500000 Bandwid	lth	#EXTM3U

<sup>&</sup>lt;sup>4</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence
	#EXT-X-VERSION:3
	#EXT-X-TARGETDURATION:11
	#EXT-X-MEDIA-SEQUENCE:0
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY
	AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v

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Claim Element	Example Infringement Evidence
	Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
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	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJID6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude <b>7</b> .ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence	
	00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	

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Claim Element	Example Infringement Evidence
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Claim Element		Example Infringement Evidence
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		#EXT-X-TARGETDURATION:11
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		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ

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Claim Element	Example Infringement Evidence
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	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
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	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL-
	ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence	
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
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Claim Element	Example Infringement Evidence	
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT	

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8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&
Key-Pair-Id=APKAIPJESLAK2PMGD4PA
#EXTINF:10.333333,
https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9-xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryl5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB-y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
#EXT-X-ENDLIST
on information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.  ach of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant
2

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Claim Element	Example Infringement Evidence
	are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle.TV to synchronize the media. <i>Id</i> . Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.

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Claim Element		Example Infringement Evidence	
[1.6] wherein the streaming comprises:	The streaming includes requesting by the media player a plurality of sequential ones of the files of one of the copies from the set of servers over a plurality of Transmission Control Protocol (TCP) connections based on the time indexes.		
requesting by the media player a plurality of sequential ones of the files of one of the copies from the set of servers over	The variant playlists file are HLS playlists. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV requests and retrieves the segments of the encoded stream specified in the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> , and each streamlet (except the first and final streamlets) is approximately 8-10 seconds long.		
a plurality of Transmission Control Protocol (TCP) connections based on the time indexes;	The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same segmented moments in the video.		
	Bandwidth Version	File line (#EXTINF: length) (portion of live stream)	
	500000 Bandwidth	#EXTM3U  #EXT-X-VERSION:3  #EXT-X-TARGETDURATION:11  #EXT-X-MEDIA-SEQUENCE:0	

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Claim Element	Example Infringement Evidence
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-ERIBXKGkK~- uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMvfBl YgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb- 4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigUQOQg L~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdkIIwDJPt16Cyeqhr-KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLYAeE 62nLYWpA-XRLIAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~vSst-smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58315&Signature=YXXHRRu4Adc2jc-XdGykv-

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Claim Element	Example Infringement Evidence	
	zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42qpY mam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~LwMBsQ XOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYWoEX kJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58315&Signature=CM-bcy4GkvIZLwyvQ-oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2ww J4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-L14ZQKe13SeDvD0M~woH-vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PY WZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU 4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ3I8tv jSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwLCE WqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeBLQ	

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Claim Element	Example Infringement Evidence
	9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAVQ_ _&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAEPSZD a9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp- 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1- UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~ 4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR- anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS- EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-
	Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9HhQp rIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33XEVC ubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3zvOOO m6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn604UoStbeC RxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn-IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsad7 BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO-V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp2vf 5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrcZyVY Sd2~kXj3CG-AuKqOtVCEx0UHFHJjX~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39nk9it xzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DVPqjXH1d cm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf00w m8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35dQoPsu 4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJyml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM8Rhb F9BSiM5ETvGlSfVMmUjlAlh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvcoG m-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-

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Claim Element	Example Infringement Evidence	
	0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7igyLj hGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaGZkvaB ObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH15~o QepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqCky3EV~g yOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-qVVkpgIZkF1HrUvTWvHcEXkVv-tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5EfbGv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4-jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987-4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28K9 4BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAxMXU8 Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVCgt Qgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3sCeV vdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	

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Claim Element	Example Infringement Evidence	
		#EXTINF:10.333333,
		https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6toED9s TTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6-Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2iI~i jh7cbzmcgb38F-mazr0uLY-Rp-E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqaCeE 0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t-ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:9.666667,
		#EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGK

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Claim Element	Example Infringement Evidence
	UkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYH XS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25D xDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80Lz LrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1s Xw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:10.125000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58230&Signature=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN- fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53Ru nAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4 ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZp KD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRw Wgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa 985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJ AnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R 0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75 YdM91BCDnFgTaB2DGhw9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oP ERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-	

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Claim Element	Example Infringement Evidence	
	OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8 IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl- bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT 1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9 uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPf N~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDAC ytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-	

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Claim Element	Example Infringement Evidence
	nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J3 9C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2 G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0FqgXFZTeKO 3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk

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Claim Element	Example Infringement Evidence		
	2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtw Vnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF- gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA &Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:9.916667,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39 QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEj13Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.333333,		
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yK A45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYN WXti2HX96KWLRLluN9-xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~Fm cQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VD volOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibm BRqlyB-		

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Claim Element	Example Infringement Evidence
	y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above.
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; <i>see also</i> RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").
	Indeed, to adapt playback between different bitrate Variant Streams, the End User Device accessing Kidoodle.TV "can use the EXTINF durations and the constraints in Section 6.2.4 to determine the approximate location of corresponding media. Once media from the new Variant Stream has been loaded, the timestamps in the Media Segments can be used to synchronize the old and new timelines precisely." RFC 8216 at 47.
	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media

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Claim Element			<b>Example Infringement Evidence</b>	e		
	Number ca different R	Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.				
	uninterrup	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").				
	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.			ce		
	Method	Host	Path	•••	Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete	

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Claim Element			<b>Example Infringement Evidence</b>	ee	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete
	entities." "SHALL first segn "[i]n orde the one w Media Se plurality Media Se As shown version o back to the	RFC 8216 at 55. When place choose which Media Segrenent to load is generally the er to play the presentation with the lowest Media Sequegment loaded." RFC 8216 of files with sequential Media equence Numbers/timestament above, although the End of the program, it quickly some 1800000 Bandwidth versions.	in URIs, which clients will use to manyback starts on the video player, "[t] ment to play first from the Media Player segment that the client has chosen to hormally, the next Media Segment" to ence Number that is greater than the at 47. That is, to playback normally, dia Sequence Numbers/timestamps at a sequence Numbers/timestamps at a sequence Numbers and the sequence Numbers at 300000 Bar rsion when bandwidth is adjusted. The ts were received from the one or more	the claylist." o play he vio he vio the vio	ient," which is the video player, "RFC 8216 at 45; id. at 47 ("The y first (see Section 6.3.3)."). Then, deo player requests and "load[s] ia Sequence Number of the last video player must request a e requests are made based on the lests the 1800000 Bandwidth, then 500000 Bandwidth, ther requests, as shown above, are

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Claim Element	Example Infringement Evidence
	On information and belief, playlists for the other resolution variants also include these segments, which correspond to the same portion of the video provided from the server(s).
[1.7] automatically requesting by the media player from the set of servers over the plurality of TCP connections subsequent portions of the video by requesting for each such portion one of the files from one of the copies dependent upon successive determinations by the media player to shift the playback quality to a higher or lower quality one of the different copies,	The End User Device automatically requests by the media player from the set of servers over the plurality of TCP connections subsequent portions of the video by requesting for each such portion one of the files from one of the copies dependent upon successive determinations by the media player to shift the playback quality to a higher or lower quality one of the different copies.  Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the media player accessing Kidoodle.TV to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.  As shown below, each of the 50000 Bandwidth and 1800000 Bandwidth version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program and progressing until the final segment of the video program. As noted above, the variant playlist file is an HLS playlist. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device
	The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-

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Claim Element	Example Infringement Evidence		
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same segmented moments in the video.		
	Bandwidth	File line (# <b>EXTINF: length</b> ) (portion of live stream)	
	500000 Bandwidth	#EXTM3U	
		#EXT-X-VERSION:3	
		#EXT-X-TARGETDURATION:11	
		#EXT-X-MEDIA-SEQUENCE:0	
		#EXTINF:10.083333,	
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.333333,	

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Claim Element	Example Infringement Evidence		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRL1Aoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,		
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ-		

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Claim Element	Example Infringement Evidence
	oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvIIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp - 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-

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Claim Element	Example Infringement Evidence
	UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA#EXTINF:9.750000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG-

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Claim Element	Example Infringement Evidence
	AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
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	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn-cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf 00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH-RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-0EsdN7ZUOam4P-E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG
	ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,

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Claim Element	Example Infringement Evidence		
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	gtQgeix/e6gBflCuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.333333,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to		

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Claim Element	Example Infringement Evidence				
		ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.666667,			
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		#EXT-X-VERSION:3 #EXT-X-TARGETDURATION:11 #EXT-X-MEDIA-SEQUENCE:0			
		#EXTINF:10.083333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-			

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Claim Element	Example Infringement Evidence			
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	#EXTINF:10.333333,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ 6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.416667,			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6			
	x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.125000,			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169			

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Claim Element	Example Infringement Evidence				
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	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXIS 2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-				

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Claim Element	Example Infringement Evidence				
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	#EXTINF:9.750000,				
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA-QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39 KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.125000,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				

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Claim Element	Example Infringement Evidence				
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.916667,				
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-				

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Claim Element	Example Infringement Evidence
	ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16
	92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXv11kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence						
			#EXT-X-ENDLIST				
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to ma uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a can receive a continuous stream of media from a server for concurrent presentation.").  The End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switch request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determine the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receive <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing she						
	Method	Host	Path	•••	Status		
	GET vcdm-cf.kidoodle.tv/7/hls/S0E4_WorldsStrongest Complete  Dude6.ts?  GET vcdm-cf.kidoodle.tv/7/hls/S0E4_WorldsStrongest Complete  Dude7.ts?						
	GET vcdm-cf.kidoodle.tv/8/hls/S0E4_WorldsStrongest Complete Dude8.ts?						
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete		

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Claim Element	Example Infringement Evidence						
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete		
	uninterru	pted playback at the best p	bitrate of the media to the current ne ossible quality." RFC 8216 at 4; see a media from a server for concurrent pro-	also i	d. ("Using this protocol, a client		
	As explained above, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the video stream at the following bandwidths:						
	• 18 • 50	800000 (referred to herein as 00000 (referred to herein as	s "300000 Bandwidth") having a restate "1800000 Bandwidth") having a rest s "500000 Bandwidth") having a rest s "800000 Bandwidth") having a restate "800000 Bandwidth") having a restate "800000 Bandwidth".	resolu solutio	ntion of 1280x720 on of 480x270		
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:						

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Claim Element	Example Infringement Evidence					
	Bandwidth	Token <sup>5</sup>				
	300000	8.m3u8?				
	Bandwidth					
	1800000	7.m3u8?				
	Bandwidth					
	500000	6.m3u8?				
	Bandwidth					
	800000	5.m3u8?				
	Bandwidth					
[1.8] said		e, the End User Device automatically requests by the media player from the set of servers				
automatically		f TCP connections subsequent portions of the video by requesting for each such portion one				
requesting including,		e of the copies dependent upon successive determinations by the media player to shift the a higher or lower quality one of the different copies. Additionally, the automatically request				
repeatedly generating a set of	includes, repeatedly generating a set of one or more factors indicative of the current ability to sustain the streaming of the video using the files from different ones of the copies.					
one or more						
factors indicative of the current	HLS "allows a rece	eiver to adapt the bitrate of the media to the current network conditions in order to maintain				
ability to sustain	uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client					
the streaming of	can receive a continuous stream of media from a server for concurrent presentation.").					
the video using the						

<sup>&</sup>lt;sup>5</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence							
files from different ones of the copies,	video stream at th	ve, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the e following bandwidths:  eferred to herein as "300000 Bandwidth") having a resolution of 480x270 referred to herein as "1800000 Bandwidth") having a resolution of 1280x720 referred to herein as "500000 Bandwidth") having a resolution of 480x270 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000 Bandwidth") having a resolution of 720x406 referred to herein as "800000						
	Bandwidth	Bandwidth Token <sup>6</sup>						
	300000 8.m3u8? Bandwidth							
	1800000 7.m3u8? Bandwidth							
	<b>500000</b> 6.m3u8? <b>Bandwidth</b>							
	800000 5.m3u8?							

<sup>&</sup>lt;sup>6</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence						
	The End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.						
	Method	Host	Path	•••	Status		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete		

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Claim Element	Example Infringement Evidence					
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete	
[1.9] wherein the set of one or more factors relate to the performance of the network; and	allow Kidd an integer timestamps. Thus, "[m] 8216 at 43 The End U the determ. In response receives the conditions continuous client first reloads the HLS "allow uninterrupt can received. The End U streamlets, request and	bodle to synchronize the media to synchronize within the media to synchronize within the media to synchronize the media to synchronize to requested file streamlet from a serous as available bandwidth as tream of media from a serous as available bandwidth as tream of media from a serous and then down a receiver to adapt the bit and the best post a continuous stream of media from a serous a receiver to adapt the bit and the best post a continuous stream of media from a determination that a receive the 300000 Bandwidth receive the 3000	atching content in Variant Streams edia. RFC 8216 at 43. And "[e]ach mber. The Discontinuity Sequence ronize Media Segments across diff Streams MUST have matching Discussed streamlets via one or more network conditions and/or available amlet via an HTTP GET request, a rom the server via the one or more h. See e.g., RFC 8216 at 4 ("Using rver for concurrent presentation."); nloads and plays each Media Segments document to discover any added attrate of the media to the current nessible quality." RFC 8216 at 4; see redia from a server for concurrent prodle.TV requests and receives the 1 the higher bitrate cannot be supported width version of the streamlets. The streamlets can be supported, and server for concurred, and server for concurred.	Media Numberent continue network e band s show network id. at also id etwork also id resent	a Segment in a Media Playlist has aber can be used in addition to the Renditions." RFC 8216 at 39. Inuity Sequence Numbers." RFC rk connections in accordance with lividth.  In above, the Kidoodle player ork connections, based on network protocol, a client can receive a secondary of the eclared within it. The client tents.").  It conditions in order to maintain add. ("Using this protocol, a client ation.").  On Bandwidth version of the the End User Device switches to a User Device then determines that	

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Claim Element	Example Infringement Evidence				
	1800000 F 1800000 F	Bandwidth version of the	treamlets. Then, the End User Device streamlets can be supported, and sub streamlets. Below is an excerpt of th requests.	seque	ently requests and receives the
	Method	Host	Path		Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete

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Claim Element	Example Infringement Evidence
	Additionally, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
[1.10] making the successive determinations to	The End User Device makes the successive determinations to shift the playback quality based on at least one of the set of factors to achieve continuous playback of the video using the files of the highest quality one of the copies determined sustainable at the time, such as network conditions and available bandwidth.
shift the playback quality based on at least one of the set of factors to	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").
achieve continuous playback of the	As explained above, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the video stream at the following bandwidths:
video using the files of the highest quality one of the copies determined sustainable at that time; and	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:

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Sandwidth 00000 Sandwidth 800000	<b>Token</b> <sup>7</sup> 8.m3u8?				
Bandwidth	8.m3u8?				
800000					
	7.m3u8?				
Bandwidth					
00000	6.m3u8?				
Bandwidth					
00000	5.m3u8?				
Bandwidth					
The End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determine the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing show the same alongside the status of the requests.  Method Host Path Status					
	andwidth  0000 andwidth  End User Device amlets. Upon a cuest and receive 500000 Bandwidth 0000 Bandwidth 0000 Bandwidth same alongside	andwidth  5.m3u8?  End User Device accessing Kidoo amlets. Upon a determination that uest and receive the 300000 Bandwidth version of the 30000 Bandwidth version of the stree 30000 Bandwidth version of the 30000 Band	5.m3u8?  End User Device accessing Kidoodle.TV requests and receives the amlets. Upon a determination that the higher bitrate cannot be suppliest and receive the 300000 Bandwidth version of the streamlets.  500000 Bandwidth version of the streamlets can be supported, an 0000 Bandwidth version of the streamlets. Then, the End User Device of the streamlets can be supported, and so 0000 Bandwidth version of the streamlets can be supported, and so 0000 Bandwidth version of the streamlets. Below is an excerpt of same alongside the status of the requests.	andwidth  5.m3u8?  End User Device accessing Kidoodle.TV requests and receives the 18000 amlets. Upon a determination that the higher bitrate cannot be supported, the diest and receive the 300000 Bandwidth version of the streamlets. The End 500000 Bandwidth version of the streamlets can be supported, and subseque 0000 Bandwidth version of the streamlets. Then, the End User Device then 0000 Bandwidth version of the streamlets can be supported, and subseque 0000 Bandwidth version of the streamlets. Below is an excerpt of the Chasame alongside the status of the requests.	End User Device accessing Kidoodle.TV requests and receives the 1800000 Bandwidth version of the amlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches a test and receive the 300000 Bandwidth version of the streamlets. The End User Device then determines 500000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives to 4000 Bandwidth version of the streamlets. Then, the End User Device then determines that the higher 40000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 40000 Bandwidth version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing same alongside the status of the requests.

<sup>&</sup>lt;sup>7</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence					
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete	
	allow Kid	loodle to synchronize the r r Discontinuity Sequence N	n]atching content in Variant Streams nedia. RFC 8216 at 43. And "[e]ach Number. The Discontinuity Sequence chronize Media Segments across diff	Medi Num	a Segment in a Media Playlist has aber can be used in addition to the	

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Claim Element	Example Infringement Evidence					
	Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.					
[1.11] presenting the video by	The End User Device presents the video by playing back with the media player on the end user station the requested files in order of ascending playback time.					
playing back with the media player on the end user station the requested files in order of ascending playback time.	In response to requesting the first streamlet via an HTTP GET request, as shown above, the End User Dea accessing Kidoodle.TV receives the requested streamlet from the server via the one or more network connections. See e.g., RFC 8216 at 4 ("Using this protocol, a client can receive a continuous stream of more from a server for concurrent presentation."); id. at 5 ("To play this Playlist, the client first downloads it a downloads and plays each Media Segment declared within it. The client reloads the Playlist as described document to discover any added segments.").					
	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandw</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device ther switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device ther determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently request and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.					
	Method	Host	Path		Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?	•••	Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete	

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Claim Element			Example Infringement Evidence	e	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete
	on the Ki users may	doodle support webpage, b	ayer provides video playback to end unttps://about.kidoodle.tv/faq/. There, incts users on how to optimize their vi	Kidoo	odle troubleshoots problems end

Claim Element	Example Infringement Evidence
	Why isn't Kidoodle.TV® working?
	We have worked hard to create a service that can be accessed across as many devices as possible, but as with all technology there are times when it may not work properly. There are a number of reasons why this can happen including simple connectivity issues to more complex ones. If you're experiencing any issues, please try the following:  1. Confirm that you are connected to a WIFI network and that the connection is strong.  2. Close the app and re-launch it.  3. Sign out of your account (if you have one) and log back in.  4. Check to see if there is a recent update, and if so, update the app.  5. Delete the app from your device and re-install it.
	If the problem persists, please contact us and we would be more than happy to try and find a solution.  When sending us a message, please take note of any error codes you may see, and provide as much detailed information as possible, including the device you're streaming on.
	Does Kidoodle.TV® work while I'm offline?  Unfortunately, Kidoodle.TV is a streaming service and as such you must be connected to a WIFI network or use data to watch.

# **EXHIBIT T**

#### **U.S. Patent No. 11,470,138 to Kidoodle**

The following claim chart shows exemplary aspects of A Parent Media Co. Inc.'s Kidoodle.TV streaming services and products ("Kidoodle") that infringe claim 14 of the '138 Patent. The chart is exemplary and should not be read to limit DISH's assertions against Kidoodle, or any other streaming services offered by A Parent Media Co. Inc. or Kidoodle as to the services or products described below. The chart should not be read to limit DISH's assertions to the patent claim charted below. Nor should the chart below be read to limit how Kidoodle infringes the claim below.

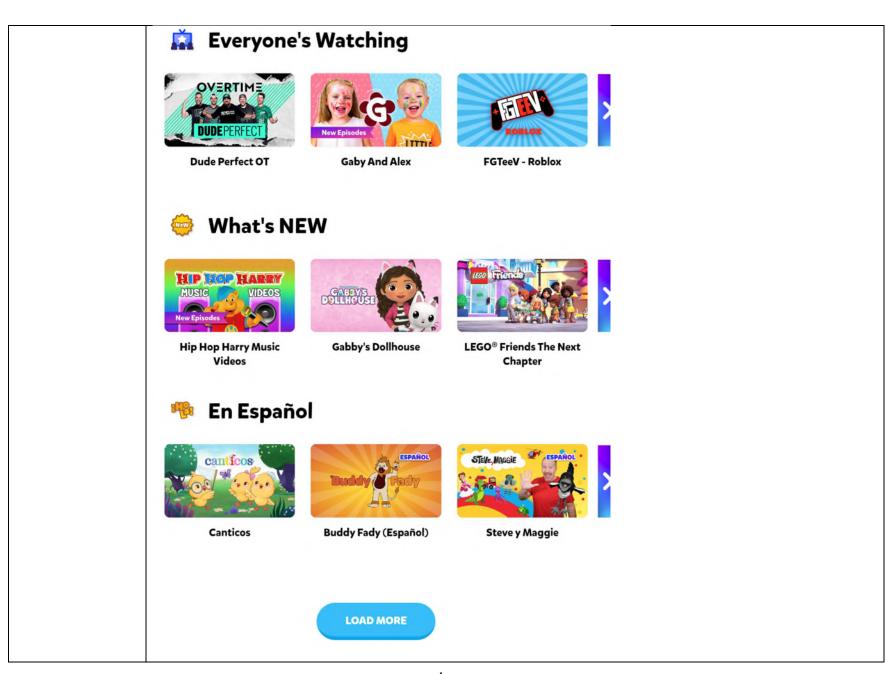
Claim Element		<b>Example Infringement Evidence</b>			
[14.pre] An end user station to stream a video over a network	Kidoodle includes information and Applications that include an end user content player device which streams a video over a network from a server for playback of the video. Kidoodle is executable by devices that obtain streams of a selected video program for playback. The streams include live streams that are obtained from one or more servers affiliated with Kidoodle over a network.				
from a server for playback of the video, the end user station comprising:	The images in this chart are from a device accessing the Kidoodle.tv website through a web browser, such as Microsoft Edge, Google Chrome, or iOS Safari. Kidoodle.tv supports all major web browsers. <i>See</i> https://about.kidoodle.tv/ ("We're available across <b>all available platforms</b> .").				
	<b>Curated Content</b>	Parental Controls	Easy-to-Watch		
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes</b> , <b>curfews</b> , <b>analytics</b> , and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.		
	https://about.kidoodle.tv/ ("We're av	ailable across all available platforms."	")		

# 

Claim Element	Example Infringement Evidence
	Kidoodle also includes applications for all platforms, including Apple App Store for iOS devices, Google Play for Android devices, Roku, and Amazon Fire TV, which also access the Kidoodle.tv website to stream video content. See <a href="https://about.kidoodle.tv/watch-now/">https://about.kidoodle.tv/watch-now/</a>
	KiDoodleth
	Download our App!
	Download on the App Store Google Play  ROKU Available on the Channel Store  WATCH ON amazon fireTV
	https://about.kidoodle.tv/watch-now/
	Upon information and belief, the aforementioned device that accesses Kidoodle.tv through a website, and the applications that access Kidoodle.tv (collectively, "End User Device") operate in the same or substantially the same way for purposes of this chart.

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Claim Element	Example Infringement Evidence					
	The one or more servers accessible by Kidoodle store video files which are streamed to the end user stations. The following are examples of the videos that may be streamed from the one or more servers to the End User Device(s). <i>See</i> <a href="https://kidoodle.tv/">https://kidoodle.tv/</a> .					



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Claim Element	Example Infringement Evidence
	https://kidoodle.tv/.  Tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the <a href="media player embedded in the">media player embedded in the</a> Kidoodle.TV site displays more details regarding the video and provides the user with the option to view the video.  Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.
	With respect to adaptively receiving the digital stream from the video server over the network, the <a href="mailto:media player embedded">media player embedded in the Kidoodle.TV</a> site accesses adaptive bitrate streams are provided to the End User Device from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.
[14.1] a processor;	Kidoodle's content is accessible on End User Devices. https://about.kidoodle.tv/ ("We're available across all available platforms."). Example end user devices include personal computers, Macintosh computers, Apple iPhones, Apple iPads, Android phones, Android tablets, and smart TV devices equipped to access the internet via one or more network connections. The end users' devices include a processor configured to enable video streaming.

Claim Element	Example Infringement Evidence					
	***					
	Curated Content	Parental Controls	Easy-to-Watch			
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes</b> , <b>curfews</b> , <b>analytics</b> , and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.			
	See <a href="https://about.kidoodle.tv/">https://about.kidoodle.tv/</a> ("We're available across all available platforms.")					
		doodle website are from accessing the I on and belief, at least one of the devicer.	± ±			
[14.2] a digital processing apparatus memory device comprising non-transitory machine-readable instructions that, when executed,	personal computers, Macintosh comp smart TV devices equipped to access include a processor configured to ena having non-transitory machine-readal	ent is accessible on end users' devices. uters, Apple iPhones, Apple iPads, And the internet via one or more network coble video streaming. The end users' deble instructions that cause an end user on and the one or more Kidoodle serve plurality of streamlets.	droid phones, Android tablets, and onnections. The end users' devices vices also include memory devices device to establish an internet			

Claim Element	Example Infringement Evidence		
cause the processor to: establish an internet connection between the end user station and the server, wherein		nection, the devices streaming Kidoodl play on the devices via the video player	1 0
the server is configured to access at least one of a plurality of groups of streamlets;	Curated Content  No fancy algorithms here. Every show available on our service has been watched and screened by a real human being.	Parental Controls  Be the best parent, even when you're not there. Bedtimes, curfews, analytics, and more features are available to all users.	Easy-to-Watch  Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.
	The one or more servers hosting Kido segments of a video program, and eac streams, or variant playlists, comprise	e available across all available platfor codle.TV video programs store streamle th streamlet is encoded at one of numer as a plurality of streamlets at the same of colayback of the streams at a resolution	ets corresponding to particular rous resolutions. Each of the stored resolution. The arrangements of each
	connection, connected with the one or prod.kidoodle.tv for a master manife https://prod.kidoodle.tv/api/2.0/con	deo titled "Dude Perfect," the end user more Kidoodle servers, and made an st located at the following path: tent/elemental-source/web/2545/9415 Manifest" or "manifest.m3u8"). The I	HTTP GET request to 52/670158/watch/manifest.m3u8

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Claim Element	Example Infringement Evidence		
	following contents, reflecting the Uniform Resource Indicators ("URIs") of the various variant playlists hosting at least a group of streamlets:		
	#EXTM3U		
	#EXT-X-VERSION:3		
	#EXT-X-STREAM- INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"		
	8.m3u8		
	#EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"		
	7.m3u8		
	#EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"		
	6.m3u8		
	#EXT-X-STREAM-INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"		
	5.m3u8		
	File path: manifest.m3u8		
	The master playlist shows four versions of the video stream at the following bandwidths:		
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>		

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Claim Element	Example Infringement Evidence	
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each variant playlist, or version playlist, is defined by the token associated with the stream file path. For example:	
	Bandwidth	Token <sup>1</sup>
	300000 Bandwidth	8.m3u8?
	1800000 Bandwidth	7.m3u8?
	500000 Bandwidth	6.m3u8?
	800000 Bandwidth	5.m3u8?
	various qualities. 500000 or 80000	ant playlists includes segments, or streamlets, that encode the same portion of the video at a for example, the 300000 Bandwidth version can be considered a low-quality stream, the 300 Bandwidth version can be considered a medium-quality stream, and the 1800000 ion can be considered a high-quality stream.

<sup>&</sup>lt;sup>1</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element			Example Infringement	t Eviden	ce	
	in the file	above from the one or mo	ore servers hosting Kidoodle	e content.	reamlets, of the encoded video spectrum.  streamlets associated with each of	
	different co must create to make av presentation Media Play specified by As shown	opies, as the exemplary Ne a Media Playlist file (Sovailable, in the order in whom is specified by a Uniforylist contains a series of Ney a URI and optionally a by the Charles Proxy app	Media Playlist shown below ection 4) that contains a UR hich they are to be played." rm Resource Identifier (UR Media Segments that make us byte range.").	illustrate I for each ); see also I) [RFC3 up the ov	es. See RFC 8216 at 38 ("The server who RFC 8216 at 4 ("A multimedia 986] to a Playlist."); RFC 8216 at erall presentation. A Media Segmentation of the streamlet video files are hosses the stored streamlet files for	er ishes 4 ("A ent is
	playback o	n an end user device.				
	Method	Host	Path <sup>2</sup>	•••	Status	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 0.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 1.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 2.ts?		Complete	

<sup>&</sup>lt;sup>2</sup> Video path abbreviated for readability throughout.

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Claim Element		Example Infringement Evidence			
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 3.ts?		Complete
	information resolution such that the As shown for the con-	on and belief, the live events, hosted on one or more set they similarly perform the in the test data, Kidoodle stresponding playlist. The K	t videos offered to Kidoodlervers, and accessed throug demonstrated claim limitat selects the <b>1800000 Bandy</b>	e viewer gh HTTP ions. vidth ver	s hosting Kidoodle content. On s are similarly encoded at multiple Get Requests by end users' devices, rsion of the stream and makes a request st file with the following contents:
	#E	EXTM3U EXT-X-VERSION:3			
	#E	EXT-X-TARGETDURATI EXT-X-MEDIA-SEQUENCE EXTINE: 10.750000			
	htti cf. urdb g1 G3 ba Zc	e=X-j9VAHmYvweCM- olOesIErSUUPPye19SnCx9 UCjh2MBBBXuSguMBN WyC79vUAs1SasIIG1VfV aBU01zty90WpmmejGY~ oBkCdhZmLe3vjUm5MM	PoSQaIPIQ9PYd9fEqw70k LDplNuJxeg9ZzZpeEfPNo y89Kb7cBiHt17- vYOoen7gdJ9v7M~z0lVV r8nrU8n~ljj6fEYV3GeQiN EHjqRm2o1-ynSK5rFw_	kunQdE0 C~k- /REBiyy /ISEAAp	s?Expires=1692058230&Signat c9VdJUJT05ewHTOHxwr0fXs gE7A0vGww6pEpEMztwSZZ4 GW1qa5cNtQOhfX2ClzKrGHx

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Claim Element	Example Infringement Evidence		
#EXTINF:9.250000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude1.ts?Expires=1692058230&Signat ure=CDpwAf98XhRNKYFrCcv- ofhY3VrgZ6T7M~dt8AXR4VRuOrMTiwDrlCQfZ01vbPEmfi~L0OK6K9Y6rlItw3hSboVNYc- Bs8Kxtaqz~kiDoN3TvSHmiaPcpjGO03IQ5nLbwn- gcptixhXoqmhAYSfFJ8q1NrOHvq5WzlOKvx8v10snMl1mxS0fC5VRDXEYbkCvLSqe8OBa8 kev2TqT8dZw7uFepqygtWzr5C0u- 6nWGZHqw4vC0d~N50BQSxQ5bjMz28sAs1vw2KmnoYx4exlNb1EE6M6nUPCA3C9dc5tei7 fB4UUZDjALiy3x7tOF3Zd2KJg6yxsNQC3ER8sD8g98SQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.083333,			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=1692058230&Signat ure=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBd gfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA		
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signat ure=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVa HEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLf DUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-		

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Claim Element	Example Infringement Evidence	
	eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw &Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.416667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signat ure=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=1692058230&Signat ure=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz-ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53RunAwQ~p3j4P6 3FEfL-ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0-eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4ahEG-et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZpKD6UQPz8JI4 OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signat ure=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb-	

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Claim Element	Example Infringement Evidence	
	p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1 b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75YdM91BCDnFgTaB2DGh w9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signat ure=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oPERBiu3cpkU1bmx18V7z1k BeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=1692058230&Signat ure=BA-QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-	
	y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=1692058230&Signat ure=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA-	

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Claim Element	Example Infringement Evidence	
	P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9uG1gv6uaDU F-NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPfN~kJVa94-XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg-vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.666667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692058230&Signa ture=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J39C0TOfHfhkuWX3GNV~B 7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk 6YyHaHA~YwMvSqF0FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692058230&Signa	

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Claim Element	Example Infringement Evidence	
	ture=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk2w0HmAaV5 pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B- rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692058230&Signa ture=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39QN0fozRAJiDpxwfbGRLiCs cRoibOsDnp8g45-N1Dv-l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45U nLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKO etZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692058230&Signa ture=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yKA45ce57fGCLQkOTs9rLwvG KYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4l Jq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VDvolOXbtWeRISpeUtqRcyPv IEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	

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Claim Element	<b>Example Infringement Evidence</b>	
	#EXTINF:9.458333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude15.ts?Expires=1692058230&Signa ture=EmKhQ97V1kC2nux03LOh0AsSs8x3T5uYyPU7uQwFWokFiT5Z11XPDOYuvT4gX8H2 9x5ZwaGw9fzRPXaevWiB-ZyaBTwKdD5sNiXzC85OSWOECID- V1OWE4FK0zsvdbK5AhvJ3UvtNzufrrcBM9deA1B0PD8NLxZ9at3GlebQlcoyuvMPmcogOD 7uPWbGcRUMw~kfl6JvTlQDcqbh7Azckr8Pj85rDKpY7ffr3dNqHK45HTx4Hq8P6BJ5HsI7 xXzimlgev1OuXSYnXwUib-ejbAqhnf- VcwgEuwFi2u9imp45LbHP~4ChIHJ2y5zkOvk6Vd6Rhlwe5QE~-91Ya7OA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude16.ts?Expires=1692058230&Signa ture=D9tydyyyfLvc63w423qjALtY-u7peL5T09eMLvlf3qIhCt- z8xRmbnXtpHEtXxwqI~tQqCssOLXwaC-EY- 2o2wPfVMWWMVFw1vyi~T~DBrixO4J9gdgCnN7XiGrI8EbePchv5-H7e- ReOIuUWsSOryzM6xfIOIM1KN- dlXCqfCpIXnyOZOwsnVFAgxZcekcLrarB8e8SpE1wobXIogjk2DGMr3GmYymTXsGFiODw XBTMuhWRcV1TARZLMK69oozNgv6-Te97KflduUeZVt6zapVj- 6Q8ZK7x7J9EFxmFwPXe7~SFFUQTxFMNJcu0esokmKOAR2tCxznBheaUR1Gag&Key- Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXT-X-CUE-OUT: 0 #EXT-X-CUE-IN #EXTINF:8.375000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude17.ts?Expires=1692058230&Signa ture=G0-13akiy1zABYLlQcnx7Om3pfZaPh~26uL9-jwDy9bwyV6KOSVTJ9uknM13xLq12pki6n6V0cWIDrQvpsvz2Tl8~ewAUkjzwesP-	

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Claim Element	Example Infringement Evidence		
	1XnJuY9tolEBNTaipdcKKeCNLw8LB9El~9einSOyMxcXmzX7ieVVlu-A~wi2GwbcMUb-w8OlvYZjVa9yTxzoz2TUjkHqFmJQ6NJ4rrnmzIsAyFu75W71LOHC-J1vs0dbN-S581jzsrg6WtUI9CbxM59TmAdLLJfnKS7XAgU5a0u~0ZbPF5Ne4z3xFWkif4joJCRc8E991AR18BUoyFCth3z8vJDd-uDp5M-br~nKEfRI5ZvBg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA		
	#EXT-X-ENDLIST		
	The variant playlist file is an HLS playlist. Each line in the file path "361/670158/7/hls/S0E4_WorldsStrongestDude17.ts" that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the variant playlist shown above, the segments of the video are separated by commercial segments. Each of the streamlets (except the first and final streamlets of each playlist) is approximately 8-10 seconds long and returns sequential segments of the video program and/or commercial.  As long as the viewer continues watching the video and the bandwidth is adequate to support the chosen resolution, the end user device will continue to request (and Kidoodle.TV will provide) streamlets corresponding to the current, chosen resolution.		
[14.3] wherein the video is encoded at a plurality of different bitrates to create a plurality	least a low quality stream, a medium quality stream, and a high quality stream, each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded at the same		
of streams including at least a low quality stream, a medium quality	In the instant test, a personal computer accessing the Kidoodle.TV site through a web browser makes a HTTPS GET request to <b>prod.kidoodle.tv</b> for the Master Manifest of a video program titled "Dude Perfect." As shown in the excerpts of the Master Manifest below, the video available is encoded at 4 different bitrates.		
stream, and a high quality stream,	#EXTM3U		

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Claim Element	Example Infringement Evidence
each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets encoded	#EXT-X-VERSION:3  #EXT-X-STREAM- INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"  8.m3u8  #EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"
at the same respective one of the different bitrates, each group comprising at least first and second streamlets, each of the streamlets corresponding to a portion of the video;	7.m3u8  #EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"  6.m3u8  #EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"  5.m3u8
	File path: manifest.m3u8  The master playlist shows four versions of the video stream at the following bandwidths:  • 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270  • 1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720  • 500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270  • 800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406  For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:

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Claim Element	Example Infringement Evidence		
	Bandwidth	Token <sup>3</sup>	
	300000 Bandwidth	8.m3u8?	
	1800000 Bandwidth	7.m3u8?	
	500000 Bandwidth	6.m3u8?	
	800000 Bandwidth	5.m3u8?	
	Each of the bandwidth streams includes segments that encode the same portion of the video at various qualities. For example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>500000 or 800000 Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000 Bandwidth</b> version can be considered a high-quality stream.  As shown below, each of the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program, and progressing until the final segment of the video program.		
	Bandwidth	Streamlet (segment)	

<sup>&</sup>lt;sup>3</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333, https://vcdm-
		cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr-KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-

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Claim Element	Example Infringement Evidence
	t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL

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Claim Element	Example Infringement Evidence
	sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJID6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp
	- 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1- UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaB Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf- 1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu- xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
	#EXTINF:9.750000,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn-IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO-V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG-AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 10.ts?Expires=16 92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39

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Claim Element	Example Infringement Evidence	
	nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf 00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4-	

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Claim Element	Example Infringement Evidence
	jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wt0F0P1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 il~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element		Example Infringement Evidence
		#EXTINF:9.666667,
		#EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok-0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc-CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169
		2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ

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Claim Element	Example Infringement Evidence
	~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ 6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 0LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.416667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FefL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq

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Claim Element	Example Infringement Evidence
	ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXIS 2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude <mark>8</mark> .ts?Expires=169

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Claim Element	Example Infringement Evidence
	2058230&Signature=BA-QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39 KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie

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Claim Element	Example Infringement Evidence
	kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv-t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc-9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR-naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,

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Claim Element	Example Infringement Evidence
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.3333333,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude 14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided

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Claim Element	Example Infringement Evidence
	from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.
	Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle. TV to synchronize the media. <i>Id.</i> Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; see also RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number,

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Claim Element	Example Infringement Evidence
	where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
[14.4] wherein at least one of the low quality stream, the medium quality stream, and the high quality stream is encoded	As explained above, Kidoodle videos are encoded at a plurality of different bitrates to create a plurality of streams including at least low, medium, and high quality streams. Each of the low, medium, and high quality streams has a streamlet that encodes the same portion of the video at a different one of the plurality of different bitrates. Each of the streamlets comprising the low, medium, and high, quality streams are stored in variant playlists comprising a group of streamlets of the same quality at a respective bit rate. At least one of the low quality stream, the medium quality stream, and the high quality stream is encoded at a bitrate of no less than 600 kbps.
at a bitrate of no less than 600 kbps;	File path: manifest.m3u8
and	The master playlist shows four versions of the video stream at the following bandwidths:
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>
[14.5] wherein the first streamlets of each of the low	The first streamlets of each of the low quality stream, the medium quality stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes the same portion of the video at a different one of the different bitrates
quality stream, the medium quality	As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at

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Claim Element		Example Infringement Evidence
stream and the high quality stream each has an equal playback duration and each of the first streamlets encodes the same portion of the video at a different one of the different bitrates;	Stream MUST present the same content in Variant Streams MUST media. <i>Id.</i> Further, "[e]ach Med The Discontinuity Sequence Nu Media Segments across different MUST have matching Discontinuity As shown below, each of the <b>50</b> or streamlets, that encode segments arranged in ascending chronology progressing until the final segment playlist. Each line in the file that line below the #EXTINF file is Kidoodle.TV uses HTTPS GET the file above. The video files at streamlets) is approximately 8-1. The received playlists at each reconstruction of the content of the c	esolution includes video streamlets, such as: "https://vcdm-WorldsStrongestDude2.ts," "https://vcdm-WorldsStrongestDude3.ts," "https://vcdm-WorldsStrongestDude4.ts," "https://vcdm-WorldsStrongestDude5.ts," and "https://vcdm-WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each a bandwidth playlist file, there are the 17 .ts files, each corresponding to the same
	500000 Bandwidth	#EXTM3U

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Claim Element	Example Infringement Evidence
	#EXT-X-VERSION:3
	#EXT-X-TARGETDURATION:11
	#EXT-X-MEDIA-SEQUENCE:0
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-
	yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v

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Claim Element	Example Infringement Evidence
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	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv-zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW-OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0-Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY-gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000,
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ-oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2wWJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-Ll4ZQKe13SeDvD0M~woH-vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PYWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence		
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence			
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Claim Element	Example Infringement Evidence
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# Case 1:23-cv-01000-GBW Document 1-1 Filed 09/08/23 Page 750 of 863 PageID #: 804

Claim Element	Example Infringement Evidence
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	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv-t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc-9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR-naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT

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Claim Element	Example Infringement Evidence
	8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbleQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above. Similarly, on information and belief, the other bandwidth version streamlets are the same durations as the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> versions.
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media

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Claim Element	Example Infringement Evidence
	Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; <i>see also</i> RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").
[14.6] select a specific one of the low quality stream,	The End User Device select a specific one of the low quality stream, the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams.
the medium quality stream, and the high quality stream based upon a determination by the end user station to select a higher or lower bitrate version of the streams;	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").
	As explained above, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the video stream at the following bandwidths:
	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:

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Claim Element	Example Infringement Evidence				
	Bandwidth	Token <sup>4</sup>			
	300000	8.m3u8?			
	Bandwidth				
	1800000	7.m3u8?			
	Bandwidth				
	500000	6.m3u8?			
	Bandwidth				
1	800000	5.m3u8?			
1	Bandwidth				
	The End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.  Method Host Path Status			nes to nes that es the the	

<sup>&</sup>lt;sup>4</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete
	allow Kid	loodle to synchronize the r r Discontinuity Sequence N	n]atching content in Variant Streams nedia. RFC 8216 at 43. And "[e]ach Number. The Discontinuity Sequence chronize Media Segments across diff	Medi Num	a Segment in a Media Playlist has other can be used in addition to the

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Claim Element	Example Infringement Evidence				
	Thus, "[m]atching content is 8216 at 43.	n Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC			
[14.7] place a streamlet request to the server over the internet connection for the first streamlet of the selected stream;	The End User Device places a streamlet request to the server over the internet connection for the first streamlet of the selected stream.  The variant playlists file are HLS playlists. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV requests and retrieves the segments of the encoded stream specified in the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> , and each streamlet (except the first and final streamlets) is approximately 8-10 seconds long.  The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," where [X] corresponds to a unique identifier for each				
	bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the sa segmented moments in the video.				
	Bandwidth Version	File line (# <b>EXTINF: length</b> ) (portion of live stream)			
	500000 Bandwidth #EXTM3U #EXT-X-VERSION:3				
		#EXT-X-TARGETDURATION:11			
		#EXT-X-MEDIA-SEQUENCE:0			

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Claim Element	Example Infringement Evidence			
	#EXTINF:10.083333,			
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-ERIBXKGkK~- uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMvfBl YgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb- 4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg& Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.333333,			
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigUQOQg L~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdkIIwDJPt16Cyeqhr-KwvRI5XrHhc8Jn4RQXgyF4i0KVGB-yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLYAeE 62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ-t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~vSst-smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.416667,			
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58315&Signature=YXXHRRu4Adc2jc-XdGykv-			

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Claim Element	Example Infringement Evidence					
	zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42qpY mam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~LwMBsQ XOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYWoEX kJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.125000,					
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58315&Signature=CM-bcy4GkvIZLwyvQ-oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ-Ll4ZQKe13SeDvD0M~woH-vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PYWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.916667,					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwLCE WqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeBLQ					

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Claim Element	Example Infringement Evidence					
	9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAVQ_ _&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.500000,					
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAEPSZD a9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp-4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1-UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.750000, https://vcdm-					
	cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9HhQp rIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33XEVC ubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3zvOOO m6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn604UoStbeC RxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					

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Claim Element	Example Infringement Evidence					
	#EXTINF:10.125000,					
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn-IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsad7 BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO-V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp2vf 5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrcZyVY Sd2~kXj3CG-AuKqOtVCEx0UHFHJjX~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.666667,					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39nk9it xzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DVPqjXH1d cm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf00w m8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35dQoPsu 4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJyml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.916667,					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM8Rhb F9BSiM5ETvGlSfVMmUjlAlh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvcoG m-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4-					

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Claim Element	Example Infringement Evidence					
	0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7igyLj hGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaGZkvaB ObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.500000,					
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH15~o QepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqCky3EV~g yOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-qVVkpgIZkF1HrUvTWvHcEXkVv-tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5EfbGv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4-jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987-4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,					
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28K9 4BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAxMXU8 Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVCgt Qgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3sCeV vdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					

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Claim Element	Example Infringement Evidence					
		#EXTINF:10.333333,				
		https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6toED9s TTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6-Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2iI~i jh7cbzmcgb38F-mazr0uLY-Rp-E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqaCeE 0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t-ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
		#EXTINF:9.666667,				
		#EXT-X-ENDLIST				
	1800000 Bandwidth	#EXTM3U				
		#EXT-X-VERSION:3				
		#EXT-X-TARGETDURATION:11				
		#EXT-X-MEDIA-SEQUENCE:0				
		#EXTINF:10.083333,				
		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGK				

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Claim Element	Example Infringement Evidence					
	UkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.333333,					
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYH XS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25D xDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80Lz LrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.416667,					
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ- zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1s Xw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA					

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Claim Element	Example Infringement Evidence					
	#EXTINF:10.125000,					
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58230&Signature=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN- fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53Ru nAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4 ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZp KD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.916667,					
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRw Wgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa 985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJ AnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R 0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75 YdM91BCDnFgTaB2DGhw9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.500000,					
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1 58230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlSt ERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z-					

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Claim Element	Example Infringement Evidence					
	OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.750000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8 IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl- bCEffj1tx7HH4CKIT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT 1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9 uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPf N~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDAC ytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-					

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Claim Element	Example Infringement Evidence						
	nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:10.666667,						
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.916667,						
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J3 9C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2 G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0FqgXFZTeKO 3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA						
	#EXTINF:9.500000,						
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk						

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Claim Element	Example Infringement Evidence					
	2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtw Vnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF- gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA &Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:9.916667,					
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39 QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv-12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEj13Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLlkLJdb-ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXTINF:10.333333,					
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yK A45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYN WXti2HX96KWLRLluN9-xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~Fm cQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VD volOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibm BRqlyB-					

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Claim Element	Example Infringement Evidence					
	y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA					
	#EXT-X-ENDLIST					
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above.					
	The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; <i>see also</i> RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").					
	Indeed, to adapt playback between different bitrate Variant Streams, the End User Device "can use the EXTINF durations and the constraints in Section 6.2.4 to determine the approximate location of corresponding media. Once media from the new Variant Stream has been loaded, the timestamps in the Media Segments can be used to synchronize the old and new timelines precisely." RFC 8216 at 47.					
	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media					

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Claim Element	Example Infringement Evidence				
	Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.				
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").  For the instant test, the End User Device accessing Kidoodle.TV requests and receives the 1800000 Bandwidth version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the 300000 Bandwidth version of the streamlets. The End User Device then determines that the 500000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 500000 Bandwidth version of the streamlets. Then, the End User Device then determines that the higher 1800000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.				
	Method	Host	Path		Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete

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Claim Element			Example Infringement Evidence	ee	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete
	entities." "SHALL first segm "[i]n orde the one w Media Seg plurality of Media Sec As shown	RFC 8216 at 55. When place choose which Media Segment to load is generally the respectation results the lowest Media Sequence many loaded." RFC 8216 of files with sequential Media Sequence Numbers/timestam above, although the End Universe sequence of the	User Device accessing Kidoodle.TV	the clivilist." o play he vice Medi the vice and the	tent," which is the video player, RFC 8216 at 45; <i>id.</i> at 47 ("The y first (see Section 6.3.3)."). Then, deo player requests and "load[s] a Sequence Number of the last rideo player must request a e requests are made based on the

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Claim Element			<b>Example Infringement Evidence</b>	e		
	On information and belief, playlists for the other resolution variants also include these segments, which correspond to the same portion of the video provided from the server(s).					
[14.8] receive the requested first	The End U	•	oodle.TV receives the requested firs	t strea	amlet from the server via the	
streamlet from the server via the internet connection; and	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").					
	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.					
	Method	Host	Path	•••	Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete	

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Claim Element			Example Infringement Evidence	ee	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete
	RFC 821 Kidoodle at 47 ("Ti 6.3.3)."). requests a Number of Device mare made As shown version of back to th	6 at 55. When playback start. TV, "SHALL choose which he first segment to load is grand "load[s] the one with the first Media Segment and "load[s] the one with the last Media Segment based on the Media Sequent above, although the End of the program, it quickly some 1800000 Bandwidth versions.	RIs, which clients will use to make norts on the video player, "[t]he client, ich Media Segment to play first from generally the segment that the client he presentation normally, the next Make lowest Media Sequence Number to loaded." RFC 8216 at 47. That is, to alles with sequential Media Sequence Numbers/timestamps.  User Device accessing Kidoodle.TV witches to requesting the 300000 Barrision when bandwidth is adjusted. The transfer of the sequence of the s	" whi the M has ch edia S hat is playb Numb reque ndwice	Media Playlist." RFC 8216 at 45; id. hosen to play first (see Section Segment" the End User Device greater than the Media Sequence back normally, the End User bers/timestamps and the requests ests the 1800000 Bandwidth, then 500000 Bandwidth, then requests, as shown above, are

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Claim Element			<b>Example Infringement Evidence</b>	e	
[14.9] provide the received first	The End User Device accessing Kidoodle.TV provides the received streamlets to the video player embedded i the Kidoodle.TV site.				
streamlet for playback of the video.	In response to requesting the first streamlet via an HTTP GET request, as shown above the End User I				
	Method	Host	Path	•••	Status
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete

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Claim Element			<b>Example Infringement Evidence</b>	e	
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?	•••	Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete
	on the Kie users may	doodle support webpage, <u>b</u>	ayer provides video playback to end <a href="mailto:ttps://about.kidoodle.tv/faq/">ttps://about.kidoodle.tv/faq/</a> . There, acts users on how to optimize their vi	Kidoo	odle troubleshoots problems end

Claim Element	Example Infringement Evidence
	Why isn't Kidoodle.TV® working?
	We have worked hard to create a service that can be accessed across as many devices as possible, but as with all technology there are times when it may not work properly. There are a number of reasons why this can happen including simple connectivity issues to more complex ones. If you're experiencing any issues, please try the following:  1. Confirm that you are connected to a WIFI network and that the connection is strong.  2. Close the app and re-launch it.  3. Sign out of your account (if you have one) and log back in.  4. Check to see if there is a recent update, and if so, update the app.  5. Delete the app from your device and re-install it.
	If the problem persists, please contact us and we would be more than happy to try and find a solution.  When sending us a message, please take note of any error codes you may see, and provide as much detailed information as possible, including the device you're streaming on.
	Does Kidoodle.TV® work while I'm offline?  Unfortunately, Kidoodle.TV is a streaming service and as such you must be connected to a WIFI network or use data to watch.

# EXHIBIT U

#### **U.S. Patent No. 10,757,156 to Kidoodle**

The following claim chart shows exemplary aspects of A Parent Media Co. Inc.'s Kidoodle.TV streaming services and products ("Kidoodle") that infringe claim 1 of the '156 Patent. The chart is exemplary and should not be read to limit DISH's assertions against Kidoodle, or any other streaming services offered by A Parent Media Co. Inc. or Kidoodle as to the services or products described below. The chart should not be read to limit DISH's assertions to the patent claim charted below. Nor should the chart below be read to limit how Kidoodle infringes the claim below.

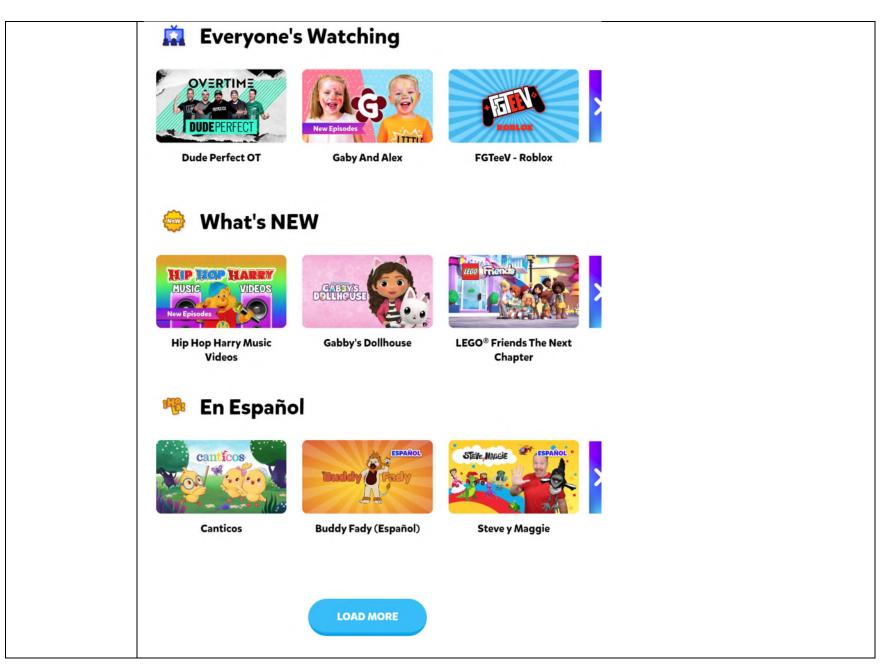
Claim Element		<b>Example Infringement Evidence</b>			
[1.pre] An apparatus for rendering a video that is adaptively received as a digital stream	Kidoodle includes information and Applications that include apparatus for rendering a video that is adaptively received as a digital stream from a video server over a network. Kidoodle is executable by devices that obtain streams of a selected video program for playback. The streams include live streams that are obtained from one or more servers affiliated with Kidoodle over a network.  The images in this chart are from a device accessing the Kidoodle.tv website through a web browser, such as Microsoft Edge, Google Chrome, or iOS Safari. Kidoodle.tv supports all major web browsers. <i>See</i>				
from a video server over a network, the apparatus comprising;		s://about.kidoodle.tv/ ("We're available across all available platforms.").			
	<b>Curated Content</b>	Parental Controls	Easy-to-Watch		
	No fancy algorithms here. Every show available on our service has been watched and screened by a <b>real human</b> being.	Be the best parent, even when you're not there. <b>Bedtimes, curfews, analytics,</b> and more features are available to all users.	Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.		
	https://about.kidoodle.tv/ ("We're av	ailable across <b>all available platforms</b> ."	)		

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Claim Element	Example Infringement Evidence
	Kidoodle also includes applications for all platforms, including Apple App Store for iOS devices, Google Play for Android devices, Roku, and Amazon Fire TV, which also access the Kidoodle.tv website to stream video content. See <a href="https://about.kidoodle.tv/watch-now/">https://about.kidoodle.tv/watch-now/</a>
	Kipoodle in the second
	Download our App!
	Download on the App Store Channel Store ROKU Available on the Channel Store WATCH ON amazon fireTV
	https://about.kidoodle.tv/watch-now/
	Upon information and belief, the aforementioned device that accesses Kidoodle.tv through a website, and the applications that access Kidoodle.tv (collectively, "End User Device") operate in the same or substantially the same way for purposes of this chart.

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Claim Element	Example Infringement Evidence					
	The one or more servers accessible by Kidoodle store video files which are streamed to the end user stations. The following are examples of the videos that may be streamed from the one or more servers to the End User Device(s). <i>See</i> <a href="https://kidoodle.tv/">https://kidoodle.tv/</a> .					



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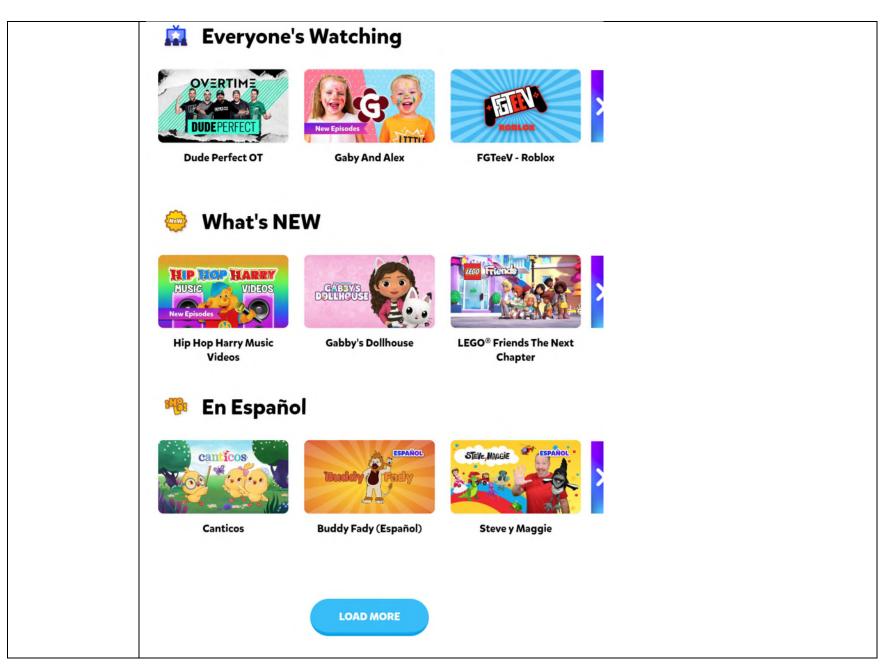
Claim Element	Example Infringement Evidence
	https://kidoodle.tv/.
	Tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the <u>media player embedded in the Kidoodle.TV</u> site displays more details regarding the video and provides the user with the option to view the video.
	Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.
	With respect to adaptively receiving the digital stream from the video server over the network, the <a href="mailto:media player embedded">media player</a> from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.
[1.1] a media player operating on the apparatus, wherein the	The End User Device accessing Kidoodle.TV includes a media player operating on the apparatus, wherein the media player is configured to stream the video from the video server via at least one transmission control protocol (TCP) connection over the network. HLS uses HTTP, which operates via TCP connections over the network.
media player is configured to stream the video	As explained above, tests were conducted on videos offered over the Kidoodle.TV site accessed on a personal computer (e.g., End User Device). As part of the testing, the End User Device was connected to the internet

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Claim Element	Example Infringement Evidence
from the video server via at least one transmission control protocol (TCP) connection over the network,	through the Charles Proxy application, which enabled the abilities to proxy the device's network traffic, to view the device's network traffic, and to throttle the network's available bandwidth. Thus, the test simulated how Kidoodle responded to lower and higher bandwidths. For the current test, a video titled "Dude Perfect" was selected. When the user selects a video from the available videos, the <a href="mailto:media player embedded in the">media player embedded in the</a> Kidoodle. TV site displays more details regarding the video and provides the user with the option to view the video.
	Selecting the icon corresponding to a video causes that video and other materials to be streamed and displayed on the user's device.
	With respect to adaptively receiving the digital stream from the video server over the network, the <a href="media player embedded in the">media player</a> from a server affiliated with Kidoodle over a network using the HTTP Live Streaming ("HLS") adaptive bitrate streaming protocol. HLS is "a protocol for transferring unbounded streams of multimedia data." Request For Comments: 8216 – HTTP Live Streaming, August 2017 ("RFC 8216") at 1. Using HLS, "a client can receive a continuous stream of media from a server for concurrent presentation." RFC 8216 at 4. HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4. With HLS, "[c]lients should switch between different Variant Streams to adapt to network conditions." RFC 8216 at 5.
	Through the established network connection, the devices streaming Kidoodle access video programs that are stored on one or more servers for display on the devices via the video player accessing the Kidoodle.TV site. <i>See</i>

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Claim Element	Example Infringement Evidence				
	also				
	Curated Content  No fancy algorithms here. Every show available on our service has been watched and screened by a real human being.	Parental Controls  Be the best parent, even when you're not there. Bedtimes, curfews, analytics, and more features are available to all users.	Easy-to-Watch  Whether you have a tablet, smart tv, or mobile phone, Kidoodle.TV is there for you. We're available across all available platforms.		
	The one or more servers accessible by	e available across all available platform Widoodle store video files which are somether that may be streamed from the one	treamed to the end user stations.		



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Claim Element	Example Infringement Evidence
	https://kidoodle.tv/.
[1.2] wherein the video server stores multiple different copies of the video encoded at different bit rates as multiple sets of streamlets, wherein each of the streamlets yields a different portion of the video on playback, wherein the streamlets across the different copies yield the same portions of the video on playback, and	The video server stores multiple different copies of the video encoded at different bit rates as multiple sets of streamlets, wherein each of the streamlets yields a different portion of the video on playback, wherein the streamlets across the different copies yield the same portions of the video on playback.  For example, in the instant test of a video titled "Dude Perfect," the end user station: established a network connection, connected with the one or more servers, and the End User Device made an HTTP GET request to prod.kidoodle.tv/api/2.0/content/selemental-source/web/2545/94152/670158/watch/manifest.m3u8 (hereafter referred to as the "Master Manifest" or "manifest.m3u8"). The Master Manifest returned the following contents, reflecting the Uniform Resource Indicators ("URIs") of the various variant playlists hosting at least a group of streamlets:  #EXT-X-VERSION:3  #EXT-X-VERSION:3  #EXT-X-STREAM- INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"  7.m3u8  #EXT-X-STREAM- INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"  7.m3u8  #EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"
	6.m3u8

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Claim Element	Example Infringement Evidence			
	#EXT-X-STREAINF:BANDWID 5.m3u8	AM- TH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"		
	• 300000 (re	est.m3u8  st shows four versions of the video stream at the following bandwidths:  eferred to herein as "300000 Bandwidth") having a resolution of 480x270  referred to herein as "1800000 Bandwidth") having a resolution of 1280x720  eferred to herein as "500000 Bandwidth") having a resolution of 480x270		
	For each of these selected video pro	versions, the master playlist provides a link to a playlist for the specified version of the ogram at a particular bandwidth and resolution. Each version playlist is defined by the token the stream file path. For example:		
	Bandwidth	Token <sup>1</sup>		
	300000       8.m3u8?         Bandwidth       7.m3u8?         Bandwidth       7.m3u8?			

<sup>&</sup>lt;sup>1</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

#### 

Claim Element	Example Infringement Evidence					
	500000 Bandwidth	6.m3u8?				
	800000 Bandwidth	5.m3u8?				
	Each of the bandwidth streams includes segments that encode the same portion of the video at various qualities. For example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>500000 or 800000 Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000 Bandwidth</b> version can be considered a high-quality stream.					000
	The End User Device also uses HTTPS GET requests to retrieve the segments, or streamlets, of the encode video specified in the file above.  The Media Playlist for each of the Variant Streams identifies a group of streamlets associated with each of different copies, as the exemplary Media Playlist shown below illustrates. See RFC 8216 at 38 ("The serve must create a Media Playlist file (Section 4) that contains a URI for each Media Segment that the server we to make available, in the order in which they are to be played."); see also RFC 8216 at 4 ("A multimedia presentation is specified by a Uniform Resource Identifier (URI) [RFC3986] to a Playlist."); RFC 8216 at Media Playlist contains a series of Media Segments that make up the overall presentation. A Media Segments by a URI and optionally a byte range.").				ments, or streamlets, of the encode	ed
					s. See RFC 8216 at 38 ("The serve Media Segment that the server w RFC 8216 at 4 ("A multimedia 986] to a Playlist."); RFC 8216 at	er rishes 4 ("A
	As shown by the Charles Proxy application file, partially reproduced below, the streamlet video files are hosted on a server accessible via <b>https://vcdm-cf.kidoodle.tv/</b> . The server accesses the stored streamlet files for playback on an end user device.			osted		
	Method Host		Path <sup>2</sup>		Status	

<sup>&</sup>lt;sup>2</sup> Video path abbreviated for readability throughout.

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Claim Element	Example Infringement Evidence					
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 0.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 1.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 2.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	361/670158/7/hls/S0E4 _WorldsStrongestDude 3.ts?		Complete	
	As shown of the stre	ns. n in the test data, the End U	User Device accessing Kido	odle.TV	y perform the demonstrated claim y selects the <b>1800000 Bandwidth</b> erver(s) returns the playlist file w	version
		EXTM3U				
		EXT-X-VERSION:3 EXT-X-TARGETDURAT	TON:11			
	#]	EXT-X-MEDIA-SEQUEN	NCE:0			
	#1	EXTINF:10.750000,				

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Claim Element	Example Infringement Evidence			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude0.ts?Expires=1692058230&Signat ure=X-j9VAHmYvweCM- dblOesIErSUUPPye19SnCx9oSQaIPIQ9PYd9fEqw70kunQdE0c9VdJUJT05ewHTOHxwr0fXs g1UCjh2MBBBXuSguMBNLDplNuJxeg9ZzZpeEfPNC~k- GWyC79vUAs1SasIIG1VfVy89Kb7cBiHt17- baaBU01zty90WpmmejGY~vYOoen7gdJ9v7M~z0lVVREBiyygE7A0vGww6pEpEMztwSZZ4 ZoBkCdhZmLe3vjUm5MMr8nrU8n~ljj6fEYV3GeQiNlSEAApGW1qa5cNtQOhfX2ClzKrGHx paXUKqEheDRGyCs2u3bOEHjqRm2o1-ynSK5rFw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.250000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude1.ts?Expires=1692058230&Signat ure=CDpwAf98XhRNKYFrCcv- ofhY3VrgZ6T7M~dt8AXR4VRuOrMTiwDrlCQfZ01vbPEmfi~L0OK6K9Y6rlItw3hSboVNYc- Bs8Kxtaqz~kiDoN3TvSHmiaPcpjGO03IQ5nLbwn- gcptixhXoqmhAYSfFJ8q1NrOHvq5WzlOKvx8v10snMl1mxS0fC5VRDXEYbkCvLSqe8OBa8 kev2TqT8dZw7uFepqygtWzr5C0u- 6nWGZHqw4vC0d~N50BQSxQ5bjMz28sAs1vw2KmnoYx4exlNb1EE6M6nUPCA3C9dc5tei7 fB4UUZDjALiy3x7tOF3Zd2KJg6yxsNQC3ER8sD8g98SQ&Key-Pair-			
	Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.083333,			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=1692058230&Signat ure=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGKUkDDfL7nBd gfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW-			

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Claim Element	Example Infringement Evidence			
	NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt-WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.333333,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signat ure=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVa HEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLf DUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.416667,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signat ure=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=1692058230&Signat ure=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53RunAwQ~p3j4P6			

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Claim Element	Example Infringement Evidence
	3FEfL-ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZpKD6UQPz8JI4 OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=1692058230&Signat ure=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRwWgpnq8loZdNXxJusEz1BjFd SviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0 wbL~iNVzRc2OWelQdLrCplH9mJAnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R0RNnvRIBG1 b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75YdM91BCDnFgTaB2DGh w9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=1692058230&Signat ure=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oPERBiu3cpkU1bmx18V7z1k BeG7n-P9XrAsdZrTSeBc5Z-OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp-GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK-kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=1692058230&Signat ure=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8IS2H2uktgoA

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Claim Element	Example Infringement Evidence
	vqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT1CCM4eWrFn IrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=1692058230&Signat ure=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9uG1gv6uaDU F-NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDACytArwL9~CtJ qifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2-nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw- rtvvpM2YO35x3QnHMYJlpNjIg-vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058230&Signa ture=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX- DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB 0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW 4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692058230&Signa

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Claim Element	Example Infringement Evidence
	ture=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J39C0TOfHfhkuWX3GNV~B 7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk 6YyHaHA~YwMvSqF0FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692058230&Signa ture=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk2w0HmAaV5 pV1n11kWk-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtwVnc-B- rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692058230&Signa ture=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39QN0fozRAJiDpxwfbGRLiCs cRoibOsDnp8g45-N1Dv- l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT8W~EUgXwn45U nLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CWxRJaJXKIU7fPKI0rm2WKO etZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41FmvaEMv8NErO3ANuCG1aLlkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692058230&Signa ture=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yKA45ce57fGCLQkOTs9rLwvG KYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~FmcQCx17kws4l Jq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VDvolOXbtWeRISpeUtqRcyPv IEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbleQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.458333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude15.ts?Expires=1692058230&Signa ture=EmKhQ97V1kC2nux03LOh0AsSs8x3T5uYyPU7uQwFWokFiT5Z11XPDOYuvT4gX8H2 9x5ZwaGw9fzRPXaevWiB-ZyaBTwKdD5sNiXzC85OSWOECID- V10WE4FK0zsvdbK5AhvJ3UvtNzufrrcBM9deA1B0PD8NLxZ9at3GlebQlcoyuvMPmcogOD 7uPWbGcRUMw~kfl6JvTlQDcqbh7Azckr8Pj85rDKpY7ffr3dNqHK45HTx4Hq8P6BJ5HsI7 xXzimlgev1OuXSYnXwUib-ejbAqhnf- VcwgEuwFi2u9imp45LbHP~4ChIHJ2y5zkOvk6Vd6Rhlwe5QE~-91Ya7OA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude16.ts?Expires=1692058230&Signa ture=D9tydyyfLvc63w423qjALtY-u7peL5T09eMLvlf3qIhCt- z8xRmbnXtpHEtXxwqI~tQqCssOLXwaC-EY- 2o2wPfVMWWMVFw1vyi~T~DBrixO4J9gdgCnN7XiGrI8EbePchv5-H7e- ReOIuUWsSOryzM6xfIOIM1KN- dlXCqfCpIXnyOZOwsnVFAgxZcekcLrarB8e8SpE1wobXIogjk2DGMr3GmYymTXsGFiODw XBTMuhWRcV1TARZLMK69oozNgv6-Te97KflduUeZVt6zapVj-	

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Claim Element	Example Infringement Evidence	
	6Q8ZK7x7J9EFxmFwPXe7~SFFUQTxFMNJcu0esokmKOAR2tCxznBheaUR1Gag&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXT-X-CUE-OUT: 0	
	#EXT-X-CUE-IN	
	#EXTINF:8.375000,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude17.ts?Expires=1692058230&Signa ture=G0-13akiy1zABYLlQcnx7Om3pfZaPh~26uL9-jwDy9bwyV6KOSVTJ9uknM13xLq12pki6n6V0cWIDrQvpsvz2Tl8~ewAUkjzwesP-1XnJuY9tolEBNTaipdcKKeCNLw8LB9El~9einSOyMxcXmzX7ieVVlu-A~wi2GwbcMUb-w8OlvYZjVa9yTxzoz2TUjkHqFmJQ6NJ4rrnmzIsAyFu75W71LOHC-J1vs0dbN-S581jzsrg6WtUI9CbxM59TmAdLLJfnKS7XAgU5a0u~0ZbPF5Ne4z3xFWkif4joJCRc8E991A R18BUoyFCth3z8vJDd-uDp5M-br~nKEfRI5ZvBg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXT-X-ENDLIST	
	The variant playlist file is an HLS playlist. Each line in the file path "361/670158/7/hls/S0E4_WorldsStrongestDude17.ts" that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the variant playlist shown above, the segments of the video are separated by commercial segments. Each of the streamlets (except the first and final streamlets of each playlist) is approximately 8-10 seconds long and returns sequential segments of the video program and/or commercial.	
	As long as the viewer continues watching the video and the bandwidth is adequate to support the chosen resolution, the end user device will continue to request (and Kidoodle.TV will provide) streamlets corresponding to the current, chosen resolution.	

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Claim Element	Example Infringement Evidence		
	On information and belief, the other bandwidth versions of the test video contain the same number of streamlet files.		
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.		
	Each of the bandwidth streams includes segments that encode the same portion of the video at various qualities. For example, the <b>300000 Bandwidth</b> version can be considered a low-quality stream, the <b>500000 or 800000 Bandwidth</b> version can be considered a medium-quality stream, and the <b>1800000 Bandwidth</b> version can be considered a high-quality stream.		
	As shown below, each of the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program and progressing until the final segment of the video program.		
	Bandwidth Streamlet ( <u>segment</u> )		
	500000 Bandwidth	#EXTM3U	
		#EXT-X-VERSION:3	
		#EXT-X-TARGETDURATION:11	
		#EXT-X-MEDIA-SEQUENCE:0	

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Claim Element	Example Infringement Evidence	
		#EXTINF:10.083333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.416667,

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Claim Element	Example Infringement Evidence	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7bbm3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWyJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IksfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigG12 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4Gkv1ZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- LJ4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZXxc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169	
	2058315&Signature=KgC2AQJID6~I3PRWRBQ2MHSaWt9Bs-	

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Claim Element	Example Infringement Evidence	
Claim Element	gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi-~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeU13NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp - 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1- UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaB Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf- 1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-	
	xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.750000,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X	

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Claim Element	Example Infringement Evidence	
Claim Element	EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3slh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiltN0u315rtZzKdsQn3fs1jf5arlcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG- AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c- vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.666667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=16	
	92058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39 nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DV PqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf 00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35 dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJ	
	yml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	

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Claim Element	Example Infringement Evidence	
		#EXTINF:9.916667,
		https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG
		ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
		https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16

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Claim Element	Example Infringement Evidence	
		92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wt0FOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.3333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6- Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp- E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov- BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t- ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.666667, #EXT-X-ENDLIST
	1800000 Bandwidth	#EXTM3U #EXT-X-VERSION:3

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Claim Element	Example Infringement Evidence	
	#EXT-X	TARGETDURATION:11
	#EXT-X	MEDIA-SEQUENCE:0
	#EXTIN	F:10.083333,
	2058230 PpswKqt Z92w1uI GKUkDI 0JEt0VF 3vKKd8' NRRg3F CYxuCp WdDAN	dm- lle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 &Signature=QCE8vv- I24bKtD9R7PHhN6EN6ep~60PZrADkIVI- F880J70OWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi DfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- z2lq6h6cjn01~abJhNOYQBsv- V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- Vs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- Pt9d50a8kEBRDNl3Tt- 4nC11aFXBo65h9xYFPnLKCw&Key-Pair- AIPJESLAK2PMGD4PA
	#EXTIN	F:10.333333,
	2058230 ~hrYHX ZFHjjcjc 5DxDRs 6-eT7HB ZMCopv	dm- lle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 &Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ S2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- FrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 BPb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ BuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57- lBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h8 duk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTIN	F:10.416667,

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Claim Element	Example Infringement Evidence	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058230&Signature=R83mjHLH07WWvwga8NT- JrIvMAExf37xVY3QrJOmHN-fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53 RunAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5 hv4ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qq ZpKD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXz KtRwWgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEc	

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Claim Element	Example Infringement Evidence	
	JMCREa985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQd LrCplH9mJAnzYUbb- p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I 4R0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMH Zmb75YdM91BCDnFgTaB2DGhw9yWFGGHX0- 6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS 2~1oPERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.750000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39 KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR	
	eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-	

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Claim Element	Example Infringement Evidence
	gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.666667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude 10.ts?Expires=16 92058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9V X-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp- ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah- sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H 5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyie kfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3 VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16

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Claim Element	Example Infringement Evidence
	92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV- B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- l2x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb-

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Claim Element	Example Infringement Evidence	
	ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXT-X-ENDLIST	
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.	
	Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST	

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Claim Element	Example Infringement Evidence
	have matching timestamps" to allow the video player accessing Kidoodle.TV to synchronize the media. <i>Id</i> . Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; <i>see also</i> RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.

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Claim Element	Example Infringement Evidence
[1.3] wherein the streamlets in the different copies are aligned in	The streamlets in the different copies are aligned in time such that the streamlets that play back the same portion of the video for the different copies each begin at the same playback time in relation to the beginning of the video.  Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS
time such that the streamlets that play back the same portion of the video for the different copies each begin at the same playback	provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
time in relation to the beginning of the video, and	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.
	In the instant test, a personal computer accessing the Kidoodle.TV site through a web browser makes a HTTPS GET request to <b>prod.kidoodle.tv</b> for the Master Manifest. As shown in the excerpts of the Master Manifest below, the video available is encoded at 4 different bitrates.
	#EXTM3U #EXT-X-VERSION:3
	#EXT-X-STREAM-INF:BANDWIDTH=300000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"

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Claim Element	Example Infringement Evidence	
	8.m3u8	
	#EXT-X-STREAM-INF:BANDWIDTH=1800000,RESOLUTION=1280x720,CODECS="avc1.640029,mp4a.40.2"	
	7.m3u8	
	#EXT-X-STREAM- INF:BANDWIDTH=500000,RESOLUTION=480x270,CODECS="avc1.42C01F,mp4a.40.2"	
	6.m3u8	
	#EXT-X-STREAM- INF:BANDWIDTH=800000,RESOLUTION=720x406,CODECS="avc1.4d4028,mp4a.40.2"	
	5.m3u8	
	File path: manifest.m3u8	
	The master playlist shows four versions of the video stream at the following bandwidths:	
	• 300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270	
	• 1800000 (referred to herein as " <b>1800000 Bandwidth</b> ") having a resolution of 1280x720	
	• 500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270	
	• 800000 (referred to herein as " <b>800000 Bandwidth</b> ") having a resolution of 720x406	
	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:	

#### 

Claim Element	Example Infringement Evidence	
	Bandwidth	Token <sup>3</sup>
	300000	8.m3u8?
	Bandwidth	
	1800000	7.m3u8?
	Bandwidth	
	500000	6.m3u8?
	Bandwidth	
	800000	5.m3u8?
	Bandwidth	
	For example, the 30 Bandwidth version considered a high-considered	dth streams includes segments that encode the same portion of the video at various qualities.  100000 Bandwidth version can be considered a low-quality stream, the 500000 or 8000000 can be considered a medium-quality stream, and the 1800000 Bandwidth version can be uality stream.  1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
	500000 Bandwid	
	Soudo Dandwid	II #EATIVISU

<sup>&</sup>lt;sup>3</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element	Example Infringement Evidence
	#EXT-X-VERSION:3
	#EXT-X-TARGETDURATION:11
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Claim Element	Example Infringement Evidence
	Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42 qpYmam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~L wMBsQXOJRCpWmU-vG6QW- OE0qu0cQmkAfUvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYW oEXkJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigG12 Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

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Claim Element	Example Infringement Evidence	
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		#EXTINF:9.500000,
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude 12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA

## Case 1:23-cv-01000-GBW Document 1-1 Filed 09/08/23 Page 817 of 863 PageID #: 871

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Claim Element		Example Infringement Evidence
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		https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~- ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI2 5DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ

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Claim Element	Example Infringement Evidence
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=169 2058230&Signature=eBd8Be4aj- PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQka Z-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei- 2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6 x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
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Claim Element	Example Infringement Evidence
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Claim Element	Example Infringement Evidence
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKi Nv9uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJyt MPfN~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrN DACytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
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Claim Element	Example Infringement Evidence	
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1- ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v- G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN- 38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-	
	B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.500000,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv-	
	t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6	
	XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT	

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Claim Element	Example Infringement Evidence
	8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXv11kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXT-X-ENDLIST
	On information and belief, playlists for the other resolution variants also include these segments, or streamlets, also arranged in ascending chronological order and corresponding to the same portion of the video provided from the Kidoodle server(s). Also, on information and belief, other videos streamed using the End User Device and the video player accessing Kidoodle.TV (such as live videos) provide the same limitations.  Each of the low-quality stream, medium-quality stream, and high-quality stream comprise a group of streamlets that are encoded at the same respective one of the different bitrates. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams

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Claim Element	Example Infringement Evidence
	are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. And HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the video player accessing Kidoodle. TV to synchronize the media. <i>Id.</i> Further, "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
	The video server stores the video wherein "each of the low quality stream, the medium quality stream, and the high quality stream comprising a group of streamlets." The HLS protocol indicates that "[a] Media Playlist contains a list of Media Segments, which, when played sequentially, will play the multimedia presentation." RFC 8216 at 4; <i>see also</i> RFC 8216 at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments."); RFC 8216 at 4 ("A Media Playlist contains a series of Media Segments that make up the overall presentation.").
	Each of the Media Segments in HLS yields a different portion of the video on playback. For example, HLS provides that "[e]ach segment in a Media Playlist has a unique integer Media Sequence Number. The Media Sequence Number of the first segment in the Media Playlist is either 0 or declared in the Playlist (Section 4.3.3.2). The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one." RFC 8216 at 6. As such, "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6. Thus, each of the streamlets in a set must yield a different portion of the video on playback.
	The streamlets across the different copies yield the same portions of the video on playback. As set forth above, each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43.

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Claim Element		Example Infringement Evidence
[1.4] wherein the media player streams the video by: requesting sequential streamlets of one of the copies from the video server according to the playback times of the streamlets by transmitting hypertext transport protocol (HTTP) GET requests that identify the	server according to the play GET requests that identify to The variant playlists file are of the segments in seconds. the End User Device access in the file above. The video streamlets) is approximately The received playlists at eac cf.kidoodle.tv//[X]/hls/S0/cf.kidoodle.tv//[X]/hls/s0/cf.kidoodle.tv//[X]/hls/s0/cf.kidoodle.tv//[X]/hls/s0/cf.kidoodle.tv//[X]/hls/s0/cf.kidoodle.tv//[X]/hls/s0/cf.kidoodle.tv//[X]/hls/s0/cf.kidoodle.tv//[X]/hls/s0/cf.kidoodle.tv//[X]/hls/s0/cf.kidoodle.t	desting by the media player sequential streamlets of one of the copies from the video back times of the streamlets by transmitting hypertext transport protocol (HTTP) the selected streamlets stored by the video server.  HLS playlists. Each line in the file that begins with "#EXTINF" specifies the length The line below the #EXTINF file is the location of the video file. In the present test, ing Kidoodle.TV requests and retrieves the segments of the encoded stream specified files are hosted at <b>vcdm-cf.kidoodle.tv</b> , and each streamlet (except the first and final y 8-10 seconds long.  Ch resolution includes video streamlets, such as: "https://vcdm-E4_WorldsStrongestDude2.ts," "https://vcdm-E4_WorldsStrongestDude3.ts," "https://vcdm-E4_WorldsStrongestDude4.ts," "https://vcdm-E4_WorldsStrongestDude5.ts," and "https://vcdm-E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each each bandwidth playlist file, there are the 17.ts files, each corresponding to the same
selected streamlets stored	<b>Bandwidth Version</b>	File line (#EXTINF: length) (portion of live stream)
by the video server,	500000 Bandwidth	#EXTM3U
server,		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0

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Claim Element	Example Infringement Evidence
	#EXTINF:10.083333,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C-ERIBXKGkK~- uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMvfBl YgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb- 4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg& Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigUQOQg L~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdkIIwDJPt16Cyeqhr- KwvR15XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLYAeE 62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~vSst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.416667,

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Claim Element	Example Infringement Evidence	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58315&Signature=YXXHRRu4Adc2jc-XdGykv- zbom4wSDTMfKj11mU2Ayu9FrYIPq8zasLafTxbjAAFdPViFDb60a70gY42qpY mam~Zv7b9m3cpZciOee~oqhc~o7GKvkj3qHKknLA0Pqsb65sxVe03~LwMBsQ XOJRCpWmU-vG6QW- OE0qu0cQmkAflvGMVLvYp3WwWxI3gRbw6uZ0VF5mwPF0- Pzj8Y1~dK8V6zWYJ8qcAmPjKNx4Qxc2caczgxNRxz~debbCA7W9qAYWoEX kJRDttTXHtU5IKsfY- gRCPydn4wdxbr9EaiQ8rzz3JBaPoheqGUTDN6nZY8Z1yBGd9edmjRigGl2Bj9g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58315&Signature=CM-bcy4GkvIZLwyvQ- oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2ww J4tm06EN0LXJIbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9PY WZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4Kt6rU 4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lLsWZ318tv jSixRbfhbDdDppd9ufg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,  https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs- gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwLCE	

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Claim Element	Example Infringement Evidence
	WqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi- ~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA01- Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeBLQ 9oQeeUI3NiT97- uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAVQ_ _&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.500000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAEPSZD a9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp- 4g7Sbr2nMT4XujUHmdCWvmAr5yLTM74tK6elAm0~rmtqzFgkqhFj4Ihw1- UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaBBa~ 4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR- anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS- EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair- Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.750000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9HhQp rIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33XEVC ubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3zvOOO m6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn604UoStbeC RxrNpEYOudkkm79k-

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Claim Element	Example Infringement Evidence			
	d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq-o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.125000,			
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn-IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsad7 BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO-V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp2vf 5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrcZyVY Sd2~kXj3CG-AuKqOtVCEx0UHFHJjJx~ZwPqFKhaeG7VLPYqQrtzo7-T~DkokBOYJd8c-vSn0Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.666667,			
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39nk9it xzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DVPqjXH1d cm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn- cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf00w m8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35dQoPsu 4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJyml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667,			
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM8Rhb			

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Claim Element	Example Infringement Evidence			
	F9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvcoG m-nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7igyLj hGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaGZkvaB ObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,			
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqI9KuLSH15~o QepuLFyoWOBM9VywFH8c5dGGo6Q3kMzCK1z~5nkZIytuaBaRkqCky3EV~g yOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq-qVVkpgIZkF1HrUvTWvHcEXkVv-tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5EfbGv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4-jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987-4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28K9 4BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAxMXU8 Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVCgt			

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Claim Element	Example Infringement Evidence				
		Qgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3sCeV vdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
		#EXTINF:10.333333,			
		https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6toED9s TTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6-Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2iI~i jh7cbzmcgb38F-mazr0uLY-Rp-E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqaCeE 0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t-ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
		#EXTINF:9.666667, 			
		#EXT-X-ENDLIST			
	1800000 Bandwidth	#EXTM3U			
		#EXT-X-VERSION:3			
		#EXT-X-TARGETDURATION:11			
		#EXT-X-MEDIA-SEQUENCE:0			
		#EXTINF:10.083333,			

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Claim Element	Example Infringement Evidence				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=16920 58230&Signature=QCE8vv-PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmiGK UkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv- 3vKKd8V~A1041mKPpE3dR8RoIqJAE0AT2dNfNb0r5Fz~EW- NRRg3FVs5pOLH9BszfYtbjnrQ2MSMgdqBwutmWFLmoDymXFyb6Mc- CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA  #EXTINF:10.333333, https://vcdm-				
	cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=16920 58230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYH XS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25D xDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80Lz LrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.416667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=16920 58230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io- IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ- zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel- y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc- IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-				

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Claim Element	Example Infringement Evidence				
	2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1s Xw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.125000,				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude5.ts?Expires=16920 58230&Signature=R83mjHLH07WWvwga8NT-JrIvMAExf37xVY3QrJOmHN- fBuAJohvGwaz- ESUi6quFC2fGNn8sgf8K79kn3iWXSMFGjereh1nXZelv6twgHEQCCmrcf53Ru nAwQ~p3j4P63FEfL- ksYDBYQJ4pEpAYgM6Bia4JFFy5i9FZZMWYZ8IPAmAp0- eCVFtlMx9DUns8cwcsNEnYNnhiHIjC0Un3KCN1XSuuJFLnrvz2QUWmE5hv4 ahEG- et3~QVH8jZEZBkwQcOT4MsOTYRfke8viezmqt2rP7uAzuZzYOgf0Ngq0qqZp KD6UQPz8JI4OLzcxB7RToMxfzgctsNJGFzJOKcAw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.916667,				
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude6.ts?Expires=16920 58230&Signature=QYeZ05FhvOsdTlX4DmLfYej1q4pjeUj1Mbsg0grTXzKtRw Wgpnq8loZdNXxJusEz1BjFdSviPO2cvoTzdCVf1xT9S5Ef1kmmCcIEcJMCREa 985Ekdv7KU12wQAwQruyNG6psTmKxn0wbL~iNVzRc2OWelQdLrCplH9mJ AnzYUbb-p6Gl9MYXBR1wRfUVhw1e4zLzGjd24kCoAXDCKTeIZdWNpifwuV9aH2I4R 0RNnvRIBG1b4FMXu6voCIPYkhDrqMtYOyARjDLm5SeKHLP7RTMHZmb75 YdM91BCDnFgTaB2DGhw9yWFGGHX0-6rL8z6z6zhgGNrrBvgEqusc-3SHA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.500000,				

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Claim Element	Example Infringement Evidence			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude7.ts?Expires=16920 58230&Signature=R5aDQrCZJYEdD99NGdedJ7c8npijqzEmXeNoxaQXlS2~1oP ERBiu3cpkU1bmx18V7z1kBeG7n-P9XrAsdZrTSeBc5Z- OmhAt~OoW2tsbGYZwGheaZhOLi~DLew2DCbvADVgaKp- GlkC0zfQ9qafx2YJ5ZKNRvYgUYh3SSTK- kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJuiH hdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxlwSgK4 s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA&Key- Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:9.750000,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=16920 58230&Signature=BA-QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7K8 IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH-~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETReT 1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a-U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s-gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.125000,			
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude9.ts?Expires=16920 58230&Signature=FLtl6E0j6cwYevQmDJSk~dnH~jsgrzjwXXA- P6Rqbwuoa01CxjT5UB6dGzv6uVTfevstOI3i91r3nha26H7scaVP6VPrkJxKiNv9 uG1gv6uaDUF- NFKALQ3M5PNsFi6I1EVm2MO95an~CMLfRNSMtB1tHCUEWy171oJytMPf			

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Claim Element	Example Infringement Evidence			
	N~kJVa94- XjL0otyPkhPoBG~9v7Ln8lZgKLS5T7MI88QkIqNTK1BqjBK8YeysAPbrNDAC ytArwL9~CtJqifJtltHhG9PvidUiOR6Zz22Ewiq4cJS2- nhoT4m92FVYTptzyEi~NXZ9Gn1jRtBw-rtvvpM2YO35x3QnHMYJlpNjIg- vw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:10.666667,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692 058230&Signature=OWlp4nApX5IFVM4ooIb~LOvRMhzdAO6deOUN9VX-DsHXDvZlkfxKwWBJJLNncNGIHHfG09L-EM4AMq~-8GX95oQFp-ZbveQTtWkF0X6pe3jVA7rkPckk8DiQNm0zzBYxMR9p6iFUhaWe2wWah-sr2i41IlhDeFg8Muw5eMfrHCkqp29jFgpFYYdXeWelEJ22qcpXIa70U1cq2H5p4WyWQN5SB0RTsE6r~4siXatSRpLpTSpnnWEgeC9pa4Y3E4Bgo5ggxyiekfXjIVBR5qqb2UlZTE9zXwNFW4nvEj3mpES59XV3axR~gdwYpATAgO3VbbfxjwQxD7AR93CPi6Km6Q&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:9.916667,			
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=1692 058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hcBV3J3 9C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99nmnwB9T2 G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0FqgXFZTeKO 3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA			
	#EXTINF:9.500000,			

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Claim Element	Example Infringement Evidence				
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=1692 058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphpetkk 2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR- ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQtw Vnc-B-rQwaARTzxnztYW8tW~n19-HT9k~VNZaFlADhf1g2tOVGO8s3FF- gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=1692 058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4EQb39 QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJIEjl3Gh0y0ghFEAOVN2b1EWT8W ~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwqv9CW xRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvDFWue41F mvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA				
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=1692 058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gYb0yK A45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH6J9WYN WXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXvl1kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~Fm				

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Claim Element	Example Infringement Evidence			
	cQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHpm9VD volOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8gqYwbibm BRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbIeQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA			
	#EXT-X-ENDLIST			
	On information and belief, the other bandwidth file playlists also comprise 17 streamlets, each corresponding to the same portion of video as is respective counterpart in the streamlet files shown above.  The matching timestamps and Discontinuity Sequence Numbers for matching content across the Variant Streams are "in relation to the beginning of the video." For example, HLS requires that "[e]ach Media Segment MUST carry the continuation of the encoded bitstream from the end of the segment with the previous Media Sequence Number, where values in a series such as timestamps and Continuity Counters MUST continue uninterrupted." RFC 8216 at 6; <i>see also</i> RFC 8216 at 45 ("A client MUST NOT assume that segments with the same Media Sequence Number in different Variant Streams or Renditions have the same position in the presentation; Playlists MAY have independent Media Sequence Numbers. Instead, a client MUST use the relative position of each segment on the Playlist timeline and its Discontinuity Sequence Number to locate corresponding segments.").			
	Indeed, to adapt playback between different bitrate Variant Streams, the End User Device accessing Kidoodle.TV "can use the EXTINF durations and the constraints in Section 6.2.4 to determine the approximate location of corresponding media. Once media from the new Variant Stream has been loaded, the timestamps in the Media Segments can be used to synchronize the old and new timelines precisely." RFC 8216 at 47.			
	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between"			

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Claim Element		Example Infringement Evidence				
	Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.					
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").					
	For the instant test, the End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.					
	Method	Host	Path		Status	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete	
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	

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Claim Element	Example Infringement Evidence				
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete
	entities." "SHALL first segn "[i]n orde the one w Media Se plurality Media Se	RFC 8216 at 55. When place choose which Media Segment to load is generally the er to play the presentation with the lowest Media Sequegment loaded." RFC 8216 of files with sequential Meaquence Numbers/timestam	in URIs, which clients will use to manyback starts on the video player, "[t] ment to play first from the Media Player segment that the client has chosen to hormally, the next Media Segment" the ence Number that is greater than the at 47. That is, to playback normally, the Sequence Numbers/timestamps at aps.  User Device accessing Kidoodle.TV	the claylist." o play he vio Medi the v	ient," which is the video player, RFC 8216 at 45; <i>id.</i> at 47 ("The y first (see Section 6.3.3)."). Then, deo player requests and "load[s] a Sequence Number of the last rideo player must request a e requests are made based on the
		,	witches to requesting the 300000 Bar	-	

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Claim Element	Example Infringement Evidence					
	back to the <b>1800000 Bandwidth</b> version when bandwidth is adjusted. Those requests, as shown above, are "Completed," meaning the streamlets were received from the one or more Kidoodle servers.					
	On information and belief, playlists for the other resolution variants also include these segments, which correspond to the same portion of the video provided from the server(s).					
[1.5] wherein the sequential	The sequential streamlets are selected by the media player from the based upon successive determinations to shift the playback quality to a higher or lower quality one of the different copies of the video.					
streamlets are selected by the media player from the based upon successive determinations to shift the playback quality to a higher or lower quality one of the different copies	Each of the Variant Streams "describes a different version of the same content." RFC 8216 at 5. Thus, each of the Variant Streams are "encodings of the same presentation" at different bitrates. RFC 8216 at 42. Indeed, to streamlet encoding the same portion of the video in the high quality stream; allow "clients to switch between" Variant Streams seamlessly, HLS requires that "[e]ach Variant Stream MUST present the same content" on playback. RFC 8216 at 43. Further, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow the media player accessing Kidoodle.TV to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.					
of the video;	As shown below, each of the <b>500000 Bandwidth</b> and <b>1800000 Bandwidth</b> version playlists contain segments, or streamlets, that encode segments of the video program. The streamlet files within each version playlist are arranged in ascending chronological order, beginning with the first segment of the video program and progressing until the final segment of the video program. As noted above, the variant playlist file is an HLS playlist. Each line in the file that begins with "#EXTINF" specifies the length of the segments in seconds. The line below the #EXTINF file is the location of the video file. In the present test, the End User Device accessing Kidoodle.TV uses HTTPS GET requests to request and retrieve the segments of the encoded stream specified in the file above. The video files are hosted at <b>vcdm-cf.kidoodle.tv</b> .					
	The received playlists at each resolution includes video streamlets, such as: "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude2.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude3.ts," "https://vcdm-					

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Claim Element	Example Infringement Evidence	
	cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude4.ts," "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude5.ts," and "https://vcdm-cf.kidoodle.tv//[X]/hls/S0E4_WorldsStrongestDude6.ts," where [X] corresponds to a unique identifier for each bandwidth version. Within each bandwidth playlist file, there are the 17 .ts files, each corresponding to the same segmented moments in the video.	
	Bandwidth	File line (#EXTINF: length) (portion of live stream)
	500000 Bandwidth	#EXTM3U
		#EXT-X-VERSION:3
		#EXT-X-TARGETDURATION:11
		#EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333,
		https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058315&Signature=fvGyZzCNd-crO6- JwO5qr9ZOrWe4iBKqQtCIADy0p1QP6T5vlUseDqz6VJBW6C- ERIBXKGkK~-uCNrFq64LsvX~X~EPT8I5qybYZUit- SG~utXB2etV0DvNLAJ~X1eyddvt0ErrShkB5qX~6GGJ3KLB~aOR2g~aMv fBlYgNcnqULnTdfMabkpB1msPcwUwTGx6cmWonwhKmxshG3mOtZi2wb -4Q6GH9QMyfetdrYR0IMcE5nTRdFsIq0oI~VewJVwRekT1NP0o2sRbr- 8Zf6oIUQQca- 5MhhmK8jIrXB06nXuXIGJJ7GtNSh3MOvOKfZpa1sus4kIeApfH1pnrakhg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
		#EXTINF:10.333333,

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Claim Element	Example Infringement Evidence	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude3.ts?Expires=169 2058315&Signature=NBrVGRob7FBvDpUUWkhkt1xxKFHmBafs8I6DqigU QOQgL~h5Q~Yq0NMLGZw3P-M8gOhx4AtOilEJVvdklIwDJPt16Cyeqhr- KwvRI5XrHhc8Jn4RQXgyF4i0KVGB- yrpfdzCL5CCAADu7TNqaYXc3e3YUorJYCJBy7acHpcbBiJKqZ8ZaYRLY AeE62nLYWpA-XRLlAoj1CCfWJXa1qvMf5QA~UFgNLMY6uEcQKmaZ- t1VMcobjMmmtatdmy22MOpxjxsyNUjb2HRpfAL8c1SNHeq873KpiDOgl~v Sst- smdtL95EOW3XbcMCWwn6AOWccfm4OiaGmFRc29ltWn0bzw&Key- Pair-Id=APKAIPJESLAK2PMGD4PA	
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	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude5.ts?Expires=169 2058315&Signature=CM-bcy4GkvIZLwyvQ-	

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Claim Element	Example Infringement Evidence	
	oxof1mPajleJMQluY97Tg9BZJwOM~WtZkXBZt8jQCZyLCiKyMzFkW8zJ2 wwJ4tm06EN0LXJlbMoqqPv016a2e1ZZgseCqJfZoh16wOAZ- Ll4ZQKe13SeDvD0M~woH- vQKw42sb3nj5TdJorlFZvXc2~09o53WMabP6RbQKXAyRH7dgIcPALjaz9P YWZjexiH9CfkBxqDGxU60AUdaQWMuCg6BonPzi75uos6Db51gUdwhA4 Kt6rU4R~Y~rSNwhzrVPGJaf420KJuMrZ4OwCm8JxawqgUzsktXHFXr12lL sWZ3I8tvjSixRbfhbDdDppd9ufg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667,	
	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude6.ts?Expires=169 2058315&Signature=KgC2AQJlD6~I3PRWRBQ2MHSaWt9Bs-gRFxvlIqKa1DjYdx~KWx4if37CKHzpDTZHSDCT4WBkFrp0~50mxs7JJwL CEWqiB~2fHF9-eWQCvzflgAkiG3opGexRKsSa-rfiZck1~x9ur5T1c4N2xtgi~B6a0QMdTgDeBXqq1TjeNBvkF5hcZNIIhrJA~06LkhFyKfcJjA0VLeVdAA 01-Kqf16sBrexjqtrZ3u3JTsgH0JAWm7q206Nsextsalg8bHATwdzzMVSelRhfeB LQ9oQeeUI3NiT97-uYm4qhz9OZ9EH8CPhQgiBD0k4aYl~kYNKF6GmGL~xYUE03EJYoGfAV Q_&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude7.ts?Expires=169 2058315&Signature=NUiSpRpB6A15jSSwNgDFu~AFYX3uEB9mddn7PAE PSZDa9hKSDL~qoXKBwX2Nve6xC696HQRZJQUg7Ymyu8wRa1JeVOwp	
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Claim Element	Example Infringement Evidence	
	UpCJPJCKz7yAsgLjTcy7yHXKLmxf9UHe9hKXGVPcstwgi~~QWoGDxaB Ba~4pMRQvcrsGzepoNXKL8EHzCl-8WW84Xudvf-1G6e6EUQFJQhQAsbdTNR-anlsScKypM~dskGmB-AAsYvGbGNB-MAu-xPMTZ8fS-EVRAQC8WgRmAbfLGAZO2jHO5udvay9CQHQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA  #EXTINF:9.750000,	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058315&Signature=BXa7FwbB- XvKzimvlQsEldShLD7Dm8FxgLdNJFW0jeOmgQp3JxgqMxyDM0~DTS9H hQprIM2EVLbLulCYs7d- NKHHx8TzryHNdR8InaQxrAYh8YcFyYAoXKCzlyWSpX~3ZXmsYH33X EVCubdae7tDLWyZn6X86xNQ3atXoYZnuoWgS1nq6m9yhD0XBhU8PeE3 zvOOOm6LfT35q~P6wgbOneR9NFk8uVNP1ePbLCppMjCISg~MjiW2cGn6 04UoStbeCRxrNpEYOudkkm79k- d7dqpYYjQyGIBXuoip7r~nEeeh38AX2b82XIPTTHL~B0g8HLjcSq- o2dQKyTvcEFrc2g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.125000, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude9.ts?Expires=169 2058315&Signature=NMtzBCclF1SeF9lDw3sIh3PwsEJPGn- IP7fz899CyR1gjwxlJZC7mewQiItN0u315rtZzKdsQn3fs1jf5arIcH5~fva5LPsa d7BNroUM8TUWIs92vyu3EtyoN71SC01~aSAhpx7hPFGtVzRxcK-FhO- V9UUEXSTMM2NQ11q9lOSuPewQ~NL~15SLz8bunor4vWiZi8mOgi~9fSp 2vf5HTZ4j59UDF181IdPVlrS0XXS6wDeqdlRnpyOmHgqoFKq~jTTSJGwrc ZyVYSd2~kXj3CG-	

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Claim Element	Example Infringement Evidence
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	https://vcdm-cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude10.ts?Expires=1692058315&Signature=R2~vr3s6Owo5idp0hos3MTQXuecliPf~W39uuzVpq39nk9itxzFoqRuMFHFYOK~M37d18GcOmxDcHNnFeg~dK6PkFTpwX1~DVPqjXH1dcm6vs77JK-SvtFakhdyG61t-uxy1ee~Prnd4PsTr7Fl4R44CjT6Qn-cuKAeHbeR7siFuiht7i3o3NvobuaP3JwCFbg137yWhI60HzG8hm90TlNYssf00wm8ZG6nmI5uuPpdd6HvGKcDkWtkbdstu0iAUhovu39Qrpfj4jKvErcR35dQoPsu4e1JO1YHG6cM4aw7cdgKpikUEsoRXzywsZfFSFDNQtLIHObwbaJyml8sALw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
	#EXTINF:9.916667,
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058315&Signature=O9jNkNgqE4UW1SqyVuuUCld1GtqcdpHTNbCQacM 8RhbF9BSiM5ETvGlSfVMmUjlAIh3FskO4rarWGIH- RnWICAIQ3paEghAeuOoBV3qBN0siaaPWXmfn8W09yd3WkF1GzOixCvc oGm- nT4Wbh4ug5XnuJQiuBkNBQXEJdagpXGiGDyqbQJVbUcMZvgqX1v4- 0EsdN7ZUOam4P- E7plk9mJuNj73aEtyZR2bWzaecBcfZDmeqFMjgQLC7CN1cVk1Aq3~yiR7ig yLjhGr6K4wMwQgegacnUXrxhXkmUiTgGYWplU25CPSygP9iRw4tkjqaG ZkvaBObkjdcUdlBpGGT4g&Key-Pair-Id=APKAIPJESLAK2PMGD4PA
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Claim Element	Example Infringement Evidence	
	https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058315&Signature=A9A1RtqyMeazN9uYlzbiBplwHsH21SDwjqf9KuLSH 15~oQepuLFyoWOBM9VywFH8c5dGo6Q3kMzCK1z~5nkZlytuaBaRkqC ky3EV~gyOgk-ln4Tba-lWY28hQEtk-7zVu0Iy8uRq- qVVkpgIZkF1HrUvTWvHcEXkVv tXYkroFNP6s1SuhfM1hqtAb70XbGuF4~T13u5GBxBDlsJKbjAaaIPfj~o5Efb Gv~JSoe9J9HYaRHCSW~j-1KxChpohXPk06AfiFcxSvBEq-V4- jxp8ui18AYUAGs7ZV44Jfp~6dIgOZg987- 4JZQy7PUoJV5iYAxta82HRLZ6N1WaV-Rg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058315&Signature=AHXYRnATKUZyMuOhztT-QJAvTF2gb- ~46Y4MxHgGFhXF8sNTPGyK09cTsMxAXxUTPvJakQegxwER3sUSUV28 K94BVA2YFE8c8dlilP5NQBbi1v6XHq5cTFYtjTBYBNII52NjHDxibXXAx MXU8Ia-iZ8hL6vn4t- Oq4PERCTuuwiUNA~x9OHXilNNDZ6gUYag0c3kvKAqgmRMPf- 9T25wj0FmW31px87wtOFOP1REVaGfIwWUQjpxP3yXTEd4M2WZSfOVC gtQgeix7e6gBfICuZQf- ADQeLuCXxCPKV7hQp6zeR1BvZ9wSLLTLtIW9kMqIz7tOo8rQDjQ~P3s CeVvdQ&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/6/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058315&Signature=VjOGW0qbN6VkaG2chJW2H1g5i5f4sXGxYuAUi6to	

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Claim Element	Example Infringement Evidence	
		ED9sTTa5K~gqhbjQyXXGESzI8XCYxJDcScZo6-Och1tDaleJPo0c~M4G3vpumPEP068KjWTdEu1wvOBRb6JYRxIDEc3Kqd2 iI~ijh7cbzmcgb38F-mazr0uLY-Rp-E3sZB7VnGpyJfuq9vjXo9QJP8kupQa4eQq8Bi5w3PkENhekPdvZYXvjISqa CeE0zAMfp~uyAKTogyM9rBEBe-Dbe4Ina14b3uCs9M8iyyCJmZVgorHov-BPjPPAZ8FCSK9hbK~KSkvGhrFavqzy11kGFALjN4fcDF6OIknToR81t-ULSA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA #EXTINF:9.666667,
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		#EXT-X-VERSION:3 #EXT-X-TARGETDURATION:11 #EXT-X-MEDIA-SEQUENCE:0
		#EXTINF:10.083333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude2.ts?Expires=169 2058230&Signature=QCE8vv- PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl- Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPmCmi GKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5Ndok- 0JEt0VFz2lq6h6cjn01~abJhNOYQBsv-
		PpswKqtI24bKtD9R7PHhN6EN6ep~60PZrADkIVl-Z92w1uF88oJ7oOWkvXFKMQ6nldkFCWevTKXh2GXaM5xpxhb5YPnGKUkDDfL7nBdgfIE-xAUfAVNdN2h6vxpLiMzX~LNyy~of8hGQW5N

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Claim Element	Example Infringement Evidence	
	CYxuCpPt9d50a8kEBRDNl3Tt- WdDAN4nC11aFXBo65h9xYFPnLKCw&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333,	
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude3.ts?Expires=1692058230&Signature=aJLvPgoOClXLOtQqubn75s3xOFPoVq87REpmtA1NZ~hrYHXS2lrrpkid5FBs5f~c3CtijVaHEnwXrSS4IRE0hHiU2tSZwupiy57B~-ZFHjjcjcFrId4ZRyGF8nQjdyQ9jHQPaYbqo5RV8slp58KcW8q6EXSfs0I~eI25DxDRs3Pb1hLfDUDIorP0o97~oLCn1nRZUFVZD9kVCVxxOG8IEwxLjcJ6-eT7HBBuKxUJHhXe0tVgeM8O6pXE8fHMT0YXZhum8yWV4Bn57-ZMCopvlBshAiSzpHFqSFButeirrUXLW09VuzNX6P1lcK9CSOlduuqbA3h80LzLrDZuk~tezw&Key-Pair-Id=APKAIPJESLAK2PMGD4PA#EXTINF:10.416667,	tA1NZ 57B~- s0I~eI2 wxLjcJ 57-
	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude4.ts?Expires=1692058230&Signature=eBd8Be4aj-PXiM~Su8RHhMtkFyoLkmQdWAjR17uH6Io-IFLjZmqxDWKWod~9gbbai0hWOZCdn55ZxgWCQ3KSJUxW4~tjdsmxQkaZ-zS2JYvUBg2XnKkGZNFBBe8dihPO61484O1ZZFeMLpNrPE1k8Ceel-y3ljr7d2EGTrElHsoLvzgIWQNvvHEtVCwCNb7p~1hbAtmc-IHBaxLCvWoKA9Giwd1F-Xcd7C9pLd800urg-20HZuei-2UOPFj1HF9wDzLxvcciRFARA2KWgLp32cxqFNKLyagEWUbekzfoRdH6x1sXw8yILs-Xpzd3TQJweOCxNBCF3a4mg0QG4pS9NA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	smxQka Ceel- CoRdH6
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Claim Element	Example Infringement Evidence	
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Claim Element	Example Infringement Evidence	
	kKTvXU0np5Yxnbfdb5wvsY5uJkqqG4JwwkVqndWxUGcm2jqfyPh4mOQIJ uiHhdLg4riLBkFxOndpYCO47p0TrOzdTGeKjIc2kour6LSvrBBE3jK9QIRxl wSgK4s0AgtlqDkqHnu~HRUoAOGTsAqpTvZR4XBnsOFzOuqsjkIqfkPagA &Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
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	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude8.ts?Expires=169 2058230&Signature=BA- QTdAdakzDLy1HjCuevDl14z~Kj34Zrr~KbCdMZQUq5Mx2Pyv6TE3Tq6qI7 K8IS2H2uktgoAvqXgENGa~4VvWZuM5qoNiD7T5Ji1wlla8vsu21GqGY39 KMl-bCEffj1tx7HH4CKlT3~~9ej~ZenH- ~InJAXyzMraRSwe7zJBxtOzCbPg3mZthehMWNWRcnmA6a1MNs4gXETR eT1CCM4eWrFnIrNVe3JDx3a0gicvjVf8QpCGdnnyYUSr2X-a- U0t9j9g7pCc38kS5K3f~yGxsgr7sRGkA-8H2-y4JfUClu3a2s- gBUhiI0xgotJjnISiIxbYhnNky7vg7BjEXMXg&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	
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Claim Element	Example Infringement Evidence	
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	https://vcdm-cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude11.ts?Expires=16 92058230&Signature=BgtrlBIoUmlNAZGP7p1u5vNLT~38Vqffgxbt6wE1hc BV3J39C0TOfHfhkuWX3GNV~B7pGiZ1GHNSh20MqY6~ZgP9pByfHx99n mnwB9T2G42cdSqmfBQzQYtz7iptZe0DKh6EiifYk6YyHaHA~YwMvSqF0 FqgXFZTeKO3Ssz2xRX3Zn~UIFyAzlVyHjQ1-ompog~3S0uuylSFPNb8lhZPhXEz3wlwQEed6ku3LSBgcTUxPqTeXCI~v-G44YbyXpWxGJdPG~BHfxvgMH5oSnsmDQeQfS70-tN-38PHHII3VPEIoJfiQT0Mog1V7Cog8znmhhGTCXwCV-B3UWdy9CAhNg&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.500000,	
	https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude12.ts?Expires=16 92058230&Signature=AcGGiMOj6opQRc-iQhv- t14nhy8CBRbu0kbqlL5QEsU4zB34NJGNhQZZXxk~iwPUfMeRCJeG4yphp etkk2w0HmAaV5pV1n11kWK-NV93ZRSPKyTc- 9~2SY4ZQnGkYBc7x24EHbfhSqJURBDoycVnwhtnet8XuDdKoMR-	

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Claim Element	Example Infringement Evidence	
	ZhtKcWmDKtsU9XhVpRm44~3a6d7GgzZHXOAqofK5IoEP21zPlJN6B6dQ twVnc-B-rQwaARTzxnztYW8tW~n19- HT9k~VNZaFlADhf1g2tOVGO8s3FF-gRlRbR- naZg93QkH~dYNuovpXagbO5WHYp4VMy52Wi1OZPHbdIqMBzW4gu1l6 XA&Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:9.916667, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude13.ts?Expires=16 92058230&Signature=EylzdTyslc00Kl7V5P0yRd3q0ndKhhs9I9RP50hbVJ4E Qb39QN0fozRAJiDpxwfbGRLiCscRoibOsDnp8g45-N1Dv- 12x8Ycbkhk23cZRQHMdcj7FFbX5nfGURJlEjl3Gh0y0ghFEAOVN2b1EWT 8W~EUgXwn45UnLTmBzdDbwMBexRPCKGpHQqVIPi0AxT4cVBcsZpwq v9CWxRJaJXKIU7fPKI0rm2WKOetZIPssNnlUkMeKHEJPJ4jiuUQ1B4kvD FWue41FmvaEMv8NErO3ANuCG1aLIkLJdb- ElbuwNWLep~DGNjkpSkOrDFYmCsSo1~3F~xd2k3Q8mJSDLXfqAw& Key-Pair-Id=APKAIPJESLAK2PMGD4PA	
	#EXTINF:10.333333, https://vcdm- cf.kidoodle.tv/361/670158/7/hls/S0E4_WorldsStrongestDude14.ts?Expires=16 92058230&Signature=PezMRToTNX9fYSbmRc73fxcKXzfC~Ahxmy0o~gY b0yKA45ce57fGCLQkOTs9rLwvGKYCEBgBSLTFAAOGMnW5jCPuHzaH 6J9WYNWXti2HX96KWLRLluN9- xTn8mh~ds9CX3wFKtUJXv11kHnXtZRBAXojDk9MSGE1w82tn8D4OOJz~ FmcQCx17kws4lJq0KX2Nm9G~qMPevjWHzqmPKaqZWryI5jXE8YGbhHp m9VDvolOXbtWeRISpeUtqRcyPvlEGMQsBtgT2E2IfmnXKJlPyRTR1~rR8 gqYwbibmBRqlyB- y7pwKwh~ihYySUpY0YUKnpQKSUWU5HKbleQXYWTH3g&Key-Pair- Id=APKAIPJESLAK2PMGD4PA	

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Claim Element		Example Infringement Evidence						
			 #EXT-X-ENDLIST					
	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").							
	The End User Device accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that the <b>500000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>500000 Bandwidth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>1800000 Bandwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>1800000 Bandwidth</b> version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.							
	Method	Host	Path		Status			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete			

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Claim Element		Example Infringement Evidence						
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete			
	uninterru	pted playback at the best p	bitrate of the media to the current ne ossible quality." RFC 8216 at 4; see media from a server for concurrent processing the server for concurrent processing	also i	d. ("Using this protocol, a client			
	-	ned above, the master play cam at the following bandy	vlist for the instant test video—"Dude vidths:	e Perf	ect"—shows four versions of the			
	• 18 • 50	800000 (referred to herein as 00000 (referred to herein as	s "300000 Bandwidth") having a restant as "1800000 Bandwidth") having a restant s "500000 Bandwidth") having a restant s "800000 Bandwidth") having a restant s	resolu solutio	ntion of 1280x720 on of 480x270			
	selected v		er playlist provides a link to a playlis ar bandwidth and resolution. Each ve For example:		1			

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Claim Element		Example Infringement Evidence					
	Bandwidth	Token <sup>4</sup>					
	300000	8.m3u8?					
	Bandwidth						
	1800000	7.m3u8?					
	Bandwidth						
	500000 Bandwidth	6.m3u8?					
	800000 5.m3u8?						
[1, 6]							
[1.6] repeatedly generating, by the		ce repeatedly generates, by the media player, a factor relating to the performance of the cative of an ability to sustain the streaming of the video, such as network conditions and/or					
media player, a	available bandwidt	·					
factor relating to the performance	HLS "allows a rece	iver to adapt the bitrate of the media to the current network conditions in order to maintain					
of the network	1 1	back at the best possible quality." RFC 8216 at 4; see also id. ("Using this protocol, a client					
that is indicative	can receive a continuous stream of media from a server for concurrent presentation.").						
of an ability to sustain the	As explained above, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the video stream at the following bandwidths:						
streaming of the							
video;		erred to herein as " <b>300000 Bandwidth</b> ") having a resolution of 480x270 eferred to herein as " <b>1800000 Bandwidth</b> ") having a resolution of 1280x720					
	,	erred to herein as "500000 Bandwidth") having a resolution of 480x270					
	• 800000 (ref	erred to herein as "800000 Bandwidth") having a resolution of 720x406					

<sup>&</sup>lt;sup>4</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence					
	selected video pr	versions, the master playlist provides a link to a playlist for the specified version of the ogram at a particular bandwidth and resolution. Each version playlist is defined by the token he stream file path. For example:					
	Bandwidth	Token <sup>5</sup>					
	300000 Bandwidth	8.m3u8?					
	1800000 Bandwidth	7.m3u8?					
	500000 Bandwidth	6.m3u8?					
	800000 Bandwidth	5.m3u8?					
	streamlets. Upon request and recei the 500000 Band 500000 Bandwic	evice accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the a determination that the higher bitrate cannot be supported, the End User Device switches to ve the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines that <b>lwidth</b> version of the streamlets can be supported, and subsequently requests and receives the <b>lth</b> version of the streamlets. Then, the End User Device then determines that the higher <b>idth</b> version of the streamlets can be supported, and subsequently requests and receives the					

<sup>&</sup>lt;sup>5</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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	Sandwidth version of the longside the status of the	streamlets. Below is an excerpt of th requests.	e Cha	arles "Sequence" listing sho	
Method	Host	Path		Status	
GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?	•••	Complete	
GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete	
GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete	

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Claim Element	Example Infringement Evidence
	Additionally, HLS provides that "[m]atching content in Variant Streams MUST have matching timestamps" to allow Kidoodle to synchronize the media. RFC 8216 at 43. And "[e]ach Media Segment in a Media Playlist has an integer Discontinuity Sequence Number. The Discontinuity Sequence Number can be used in addition to the timestamps within the media to synchronize Media Segments across different Renditions." RFC 8216 at 39. Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.
[1.7] adapting the successive determinations to	The End User Device adapts the successive determinations to shift the playback quality based on the factor to achieve continuous playback of the video using the streamlets of the highest quality copy of the video that is determined to be sustainable at that time.
shift the playback quality based on the factor to achieve	HLS "allows a receiver to adapt the bitrate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality." RFC 8216 at 4; <i>see also id.</i> ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation.").
continuous playback of the	As explained above, the master playlist for the instant test video—"Dude Perfect"—shows four versions of the video stream at the following bandwidths:
video using the streamlets of the highest quality copy of the video that is determined	<ul> <li>300000 (referred to herein as "300000 Bandwidth") having a resolution of 480x270</li> <li>1800000 (referred to herein as "1800000 Bandwidth") having a resolution of 1280x720</li> <li>500000 (referred to herein as "500000 Bandwidth") having a resolution of 480x270</li> <li>800000 (referred to herein as "800000 Bandwidth") having a resolution of 720x406</li> </ul>
to be sustainable at that time; and	For each of these versions, the master playlist provides a link to a playlist for the specified version of the selected video program at a particular bandwidth and resolution. Each version playlist is defined by the token associated with the stream file path. For example:

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Claim Element	Example Infringement Evidence					
	Bandwidth	Token <sup>6</sup>				
	300000	8.m3u8?				
	Bandwidth					
	1800000	7.m3u8?				
	Bandwidth					
	500000	6.m3u8?				
	Bandwidth					
	800000	5.m3u8?				
	Bandwidth					
	streamlets. Upon a request and receiv the 500000 Bandwidt 1800000 Bandwidt 1800000 Bandwidt the same alongside	ce accessing Kidoodle.TV requests and receives the <b>1800000 Bandwidth</b> version of the determination that the higher bitrate cannot be supported, the End User Device switches the <b>300000 Bandwidth</b> version of the streamlets. The End User Device then determines <b>idth</b> version of the streamlets can be supported, and subsequently requests and receives a version of the streamlets. Then, the End User Device then determines that the higher the version of the streamlets can be supported, and subsequently requests and receives the version of the streamlets. Below is an excerpt of the Charles "Sequence" listing show the status of the requests.	s to s that the			
	Method Host	Path Status				

<sup>&</sup>lt;sup>6</sup> Token abbreviated for readability. The abbreviated portions of each token are the same across all bandwidth versions. The full token identifier is shown in the original Charles file.

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Claim Element		Example Infringement Evidence						
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete			
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?		Complete			
	allow Kic	loodle to synchronize the r r Discontinuity Sequence N	n]atching content in Variant Streams nedia. RFC 8216 at 43. And "[e]ach Number. The Discontinuity Sequence chronize Media Segments across diff	Medi Nun	a Segment in a Media Playlist has aber can be used in addition to the			

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Claim Element	Example Infringement Evidence						
	Thus, "[m]atching content in Variant Streams MUST have matching Discontinuity Sequence Numbers." RFC 8216 at 43.						
[1.8] presenting the video for playback by providing the requested streamlets in order of ascending start time.	The End User Device presents the video for playback by providing the requested streamlets in order of ascending start time.  In response to requesting the first streamlet via an HTTP GET request, as shown above, the End User Device accessing Kidoodle.TV receives the requested streamlet from the server via the one or more network connections. See e.g., RFC 8216 at 4 ("Using this protocol, a client can receive a continuous stream of media from a server for concurrent presentation."); id. at 5 ("To play this Playlist, the client first downloads it and then downloads and plays each Media Segment declared within it. The client reloads the Playlist as described in this document to discover any added segments.").  For the instant test, the End User Device accessing Kidoodle.TV requests and receives the 1800000 Bandwidth version of the streamlets. Upon a determination that the higher bitrate cannot be supported, the End User Device switches to request and receive the 300000 Bandwidth version of the streamlets. The End User Device then determines that the 500000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 500000 Bandwidth version of the streamlets. Then, the End User Device then determines that the higher 1800000 Bandwidth version of the streamlets can be supported, and subsequently requests and receives the 1800000 Bandwidth version of the streamlets. Below is an excerpt of the Charles "Sequence" listing showing the same alongside the status of the requests.						
	Method Host Path Status						
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude6.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude7.ts?		Complete		

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Claim Element	Example Infringement Evidence						
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude8.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/8/hls/S0E4_WorldsStrongest Dude9.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude10.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude11.ts?	•••	Complete		
	GET	vcdm-cf.kidoodle.tv	/6/hls/S0E4_WorldsStrongest Dude12.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude13.ts?		Complete		
	GET	vcdm-cf.kidoodle.tv	/7/hls/S0E4_WorldsStrongest Dude14.ts?	•••	Complete		
	on the Kid users may	doodle support webpage, <u>b</u>	ayer provides video playback to end unttps://about.kidoodle.tv/faq/. There, sucts users on how to optimize their vi	Kidoo	odle troubleshoots problems end		

Claim Element	Example Infringement Evidence						
	Why isn't Kidoodle.TV® working?						
	We have worked hard to create a service that can be accessed across as many devices as possible, but as with all technology there are times when it may not work properly. There are a number of reasons why this can happen including simple connectivity issues to more complex ones. If you're experiencing any issues, please try the following:  1. Confirm that you are connected to a WIFI network and that the connection is strong.  2. Close the app and re-launch it.  3. Sign out of your account (if you have one) and log back in.  4. Check to see if there is a recent update, and if so, update the app.  5. Delete the app from your device and re-install it.						
	If the problem persists, please contact us and we would be more than happy to try and find a solution.  When sending us a message, please take note of any error codes you may see, and provide as much detailed information as possible, including the device you're streaming on.						
	Does Kidoodle.TV® work while I'm offline?  Unfortunately, Kidoodle.TV is a streaming service and as such you must be connected to a WIFI network or use data to watch.						